Modern American tanning

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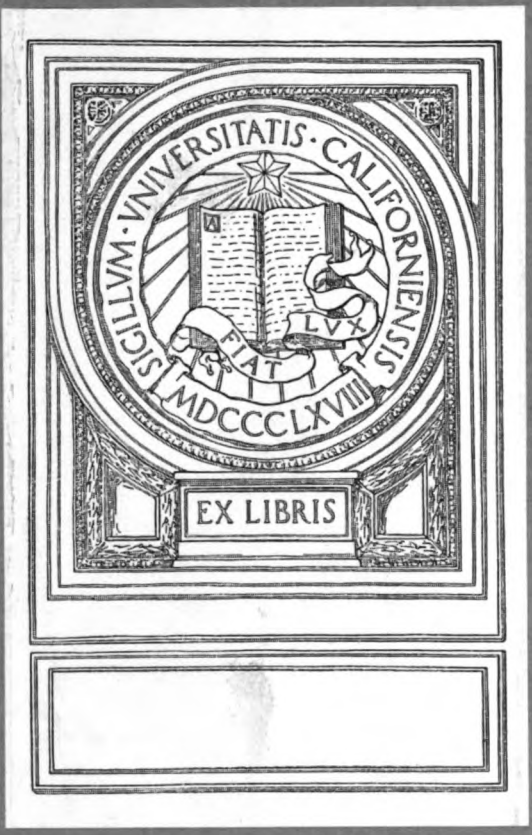

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MODERN AMERICAN TANNING

A PRACTICAL TREATISE ON THE MANUFACTURE OF LEATHER

COMPILED FROM ORIGINAL ARTICLES DESCRIBING MODERN METHODS PRINTED IN "HIDE AND LEATHER" AND WRITTEN BY WELL KNOWN TANNERY FOREMEN, SUPERINTENDENTS AND CHEMISTS

CHICAGO:
JACOBSEN PUBLISHING COMPANY
1902

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PUBLISHER'S NOTICE.

This volume is issued in response to innumerable requests from firms and individuals connected with the trade. The literature of the tanning trade is not extensive. The few volumes on tanning now in print have become practically obsolete, not because of any inherent fault in them, but by reason of the progress and achievement that have characterized the leather manufacture in recent years.

The introduction of the chrome or mineral tanning process has revolutionized the upper leather industry, and the modern process of wheel stuffing has almost completely superseded the old-fashioned systems of hand stuffing in the production of harness leather.

The finishing of calfskins on the grain side has been so successful that the old systems of currying the skins and finishing them with wax on the flesh side has been almost entirely discontinued.

In the past decade phenomenal advancement has been made in the application of chemical science to the problem of converting hides and skins into leather. The machinery constructors have also kept pace with the march of improvement. They have thoroughly and successfully applied machinery to the many operations and manipulations in the tannery that were formerly performed by hand.

The concentration of tanning materials into extracts that can be cheaply transported to the tannery has caused many radical changes in making leather. There have also been great improvements in the leaching of bark and other problems of tannery construction and operation.

In recent years the manufacture of leather has been carried to a high plane of efficiency and economy. The immense imports of leather formerly required to carry on the production of shoes, and the numberless articles made wholly or in part of leather, have been reduced to a minimum, and an immense export outlet has been opened for American leather and leather goods. This gratifying industrial victory was only made possible by the enterprise, ability and industry of the American tanner, chemist and mechanician.

HIDE AND LEATHER, the leading journal of the trade in the United States, has followed the progress of American tanning. Edited by a practical tanner, it has enlisted in its service leading chemists, tannery foremen and superintendents, who have from time to time contributed valuable papers on almost every phase and problem of leather making. These contributions, all of which first appeared in the columns of HIDE AND LEATHER, are now printed in permanent book form.

The articles cover the entire range of tanning, and the thorough system of classification will enable the reader to find the information he desires without loss of time.

The publishers desire to acknowledge their grateful appreciation of the services of the many practical men connected with the industry who have contributed much of the valuable information spread upon these pages. Without their help this volume could not have been issued.

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Hides and Skins.

PACKER HIDES AND COUNTRY HIDES.

Packer hides bring more than country hides because they are worth more. The packers know their business and have built a splendid business reputation for themselves. As many thousands of cattle are slaughtered each day at the big slaughter houses, a force of men and boys is kept steadily employed doing nothing but flaying. Long practice makes them so expert that packer hides are seldom cut and are also kept in better general condition than country hides. Packer hides are salted with coarse salt, no water being used. The percentage of leather obtained from packer hides is larger than that obtained from country hides. Besides, the fact of the packers taking off so many hides enables them to keep selections of different weights in stock all the time, which is an advantage to buyers desiring certain hides for certain purposes. While packers in times gone by have sometimes been tempted to leave fat and meat on their hides, they have reformed in the face of forcible protests from tanners, being firm believers in honesty being the best policy.

City hides are worth a little less than packer hides because as a rule they are less skillfully taken off, and there is a tendency to rather careless trim, as the owners are well aware that not being straight packer hides they can hardly expect to get the top of the market for them. Besides, buyers are less willing to pay as much for comparatively few hides and for a mixture of weights and selections as for car loads of just exactly what they want.

Country hides being taken off by country butchers are liable to be cut and to lack uniform appearance. They are not always properly handled and nowadays there are seldom any considerable number to be found in one place at one time. The regular city dealer who buys country hides is put to considerable expense in employing travelers to buy and take them up.

Country hides after they arrive at city headquarters are usually

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opened out, re-selected and placed in separate piles so that while the small country butcher is compelled to sell his little bunch of hides and skins as they run, or what is termed "flat," the city seller has to supply customers who wish for straight car loads of hides of one selection.

The condition of hides and skins affects their value. Those from the south, for instance, where the cattle are more attacked and annoyed by insects which lower the value of the hides, are not as valuable as hides from northern cattle where insects are less vicious.

Domestic goatskins are not yet numerous enough to cause an established market quotation, same as the hundreds and thousands of skins which come from foreign places. This is why domestic stock is sold principally on a basis of agreement between buyers and sellers.

Spready hides are those which are not less than six feet six inches square. They are specially sought for by manufacturers of carriage and furniture leathers, who are more particular about surface measurement of hides than thickness, such as is wanted by tanners of sole and harness leathers.

HIDE AND SKIN CLASSIFICATION.

PACKER HIDES.

Nos. 1 and 2 spready native steers, 60 pounds and up, measuring six feet six inches wide, just behind the brisket.

Nos. 1 and 2 heavy native steers, 60 pounds and up.

Nos. 1 and 2 light native steers, under 60 pounds.

Nos. 1 and 2 heavy Texas steers, 60 pounds and up.

Nos. 1 and 2 light Texas steers, 50 to 60 pounds.

Nos. 1 and 2 extreme light Texas steers, below 50 pounds.

Nos. 1 and 2 butt-branded steers, 60 pounds and up.

Nos. 1 and 2 Colorado or side-branded steers, 60 pounds and up.

Nos. 1 and 2 heavy native cows, 55 pounds and over.

Nos. 1 and 2 light native cows, under 55 pounds.

Nos 1 and 2 branded cows, all weights.

Nos. 1 and 2 native bulls, all weights.

Nos. 1 and 2 branded bulls, all weights.

Pates per 100 pounds or per ton.

From November 1 to June 1, Texas steers having more than four grubs are classed as No. 2 hides, selling at 1 cent under No. 1's. Colorados are grubbed from December 1 to June 1. Branded cows are grubbed from November 1 to June 1. Other descriptions carry the

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grubbing privilege from January 1 to June 1. Otherwise packer hides are all classed as No. 1's except where a cut in the body of the hide depreciates its value.

COUNTRY HIDES AND SKINS.

Nos. 1 and 2 heavy steers, 60 pounds and up.
Nos. 1 and 2 heavy cows, 60 pounds and up.
Nos. 1 and 2 buff hides, 40 to 60 pounds.
Nos. 1 and 2 side-branded steers, all weights.
Nos. 1 and 2 side-branded cows, all weights.
Nos. 1 and 2 bulls, all weights.
Nos. 1 and 2 extreme light hides, 25 to 40 pounds.
Nos. 1 and 2 calfskins, 8 to 15 pounds, not containing skins with kip hair.
Nos. 1 and 2 light calfskins, 7 to 8 pounds.
Nos. 1 and 2 kip, 15 to 25 pounds.
Deacons, 7 pounds and down.
Slunks, skin of an unborn calf.
Nos. 1 and 2 horsehides, all weights.
Pony, colt skins and glue stock.
Hogskins.

The customary spread between No. 1 and 2 hides is 1 cent per pound in buffs and heavy cows; 1 cent on extreme lights; 1 cent on steers and 1½ cents on calf and kip. Bulls and branded steers and cows usually sell flat, that is to say, taken as they run, not selected. Deacons, slunks, hogskins and horsehides sell by the piece. Size, liability from cuts or dragging on the hair side determine the grade of a horsehide.

Packer and country sheep pelts.
Packer and country lambs.
Packer and country shearlings.
Montana butcher dry pelts, full wooled.
Utah butcher dry pelts, full wooled.
Colorado and New Mexico dry pelts, butchers.
Montana and Utah murrains.
Dry flint shearlings, good stock.
Dry flint shearlings, damaged.
Colorado and New Mexico, country collections.

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DRY HIDES.

Indians, trimmed, 16 pounds and up.
Montana butchers, trimmed, 16 pounds and up.
Montana butchers, untrimmed, 18 pounds and up.
Colorado butchers, trimmed, 16 pounds and up.
Colorado butchers, untrimmed, 18 pounds and up.
Utahs, California trim, butchers.
Light dry hides, westerns, 12 to 18 pounds.
Short trimmed, 16 pounds and up.
Long trimmed, 18 pounds and up.
Dry kips, natives, 5 to 12 pounds.
Dry kips, westerns, 5 to 12 pounds.
Dry calf, as to hair.
Dry bulls, all weights.
Dry fallen hides, heavy.
Dry salted, heavy.
Dry salted hides, light.

RECIPE FOR HIDE POISON.

Poison to prevent damage by insects during the summer may be made as follows:

Put 40 pounds of red or white arsenic in a kerosene barrel with 1 pound of concentrated lye. Fill with water and let stand for one week. Of this mixture, take two pails and pour into an oil barrel full of water. The poison is now ready for use and should be sprinkled with an ordinary sprinkling can on both sides of the hides or skins.

TANNERS' HIDE TRIM.

The cut on opposite page shows the usual form and trim of a hide taken off by country butchers. The "Tanners' Trim," which was adopted some years ago by the Tanners' Hide and Leather Association of the United States, is shown by the dotted lines, indicating what should be taken off; and the letters *a* and *b* show bad form in skinning.

The parts marked to be cut off are worthless to the tanner, but have a value for glue stock, yet from distant points this value would not equal the cost of freight. Butchers will see how a large part of the trim on this hide would be avoided by care in skinning.

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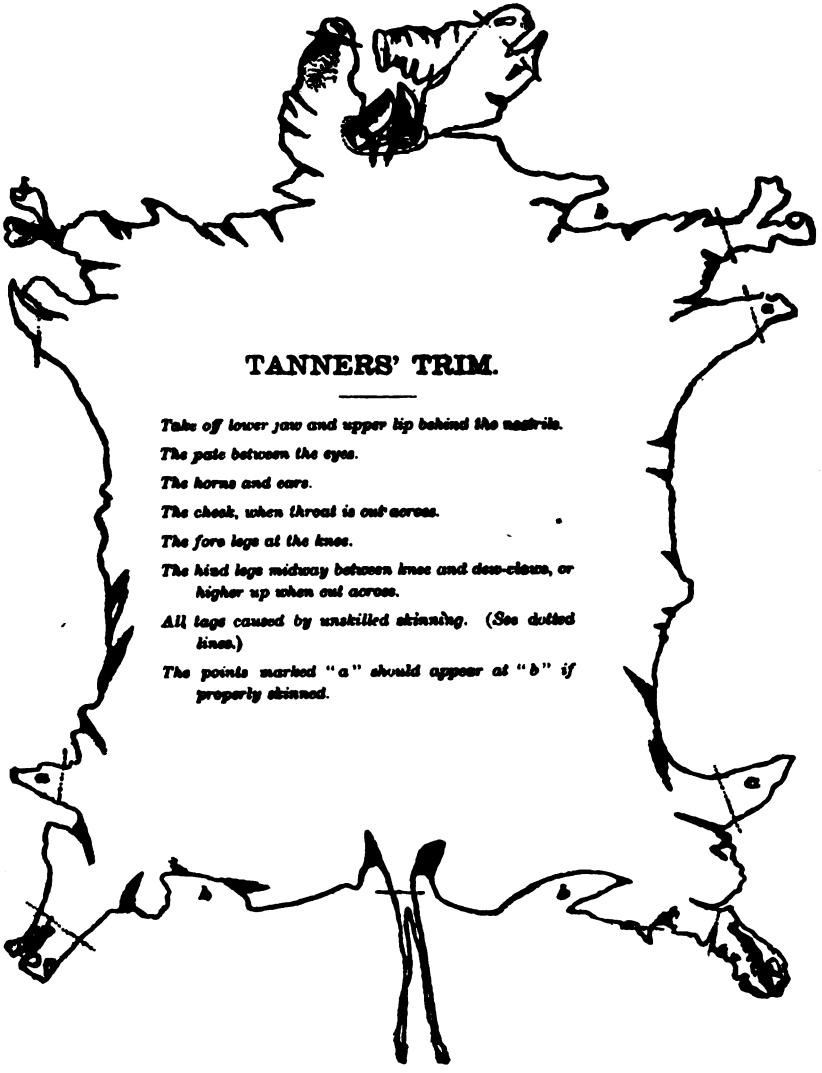
A "COUNTRY" HIDE.



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The trim is nearly the same as has been made in New York for years. All foreign hides and some western are trimmed even closer than this.

It will increase the popularity of any regular shipper to put them in this shape, and a considerable saving of freight and risk of damage will be avoided. The tanners are demanding it shall be done.

Some other points of importance may be mentioned here. Sunburned hides cause much loss. It is believed that this occurs in the first twenty-four hours after hide is taken off. If butchers will leave hides spread out in shade for that time before hanging up, it may be avoided. Scored, grubby, fallen and badly branded hides are more and more avoided by tanners. In New York all such hides go at one-third off. The western hides will soon have to conform to some rule. Hide houses are crowded with such, which tanners will not take.

Butchers and dealers should strive to improve the condition of hides and skins for market.

PACKER HIDE TRIM.

The cut on opposite page represents the famous Chicago packer hide trim, so-called from being taken off in the great slaughter or packing houses of Chicago. This method is being followed in the leading slaughter houses of the east, south and west of Chicago. The value and popularity of these hides are not only due to the excellent manner of flaying, but to the absence of cuts and jagged useless pieces that are usually found on country hides. Besides, packer hides are cured so evenly and honestly in coarse salt, that tanners seldom have reason to complain of shrinkage in weight, salt rust or other damage. Hence it will be seen there is no secret involved in the method of taking off packer hides. It simply means careful and painstaking system.

A packer hide with as high as four grub holes is classed and sold as a strict No. 1.

A No. 1 country hide must be entirely free of grubs and cuts; and even on this close selection it is less liked than the packer take-off. There is less trouble and fewer complaints in handling packer hides than in dealing in country hides.

Tanners are usually willing to buy packer hides, and pay the highest market prices. The saving of waste is considerable, and they pay enough extra to compensate the butcher for trimming the hides properly.

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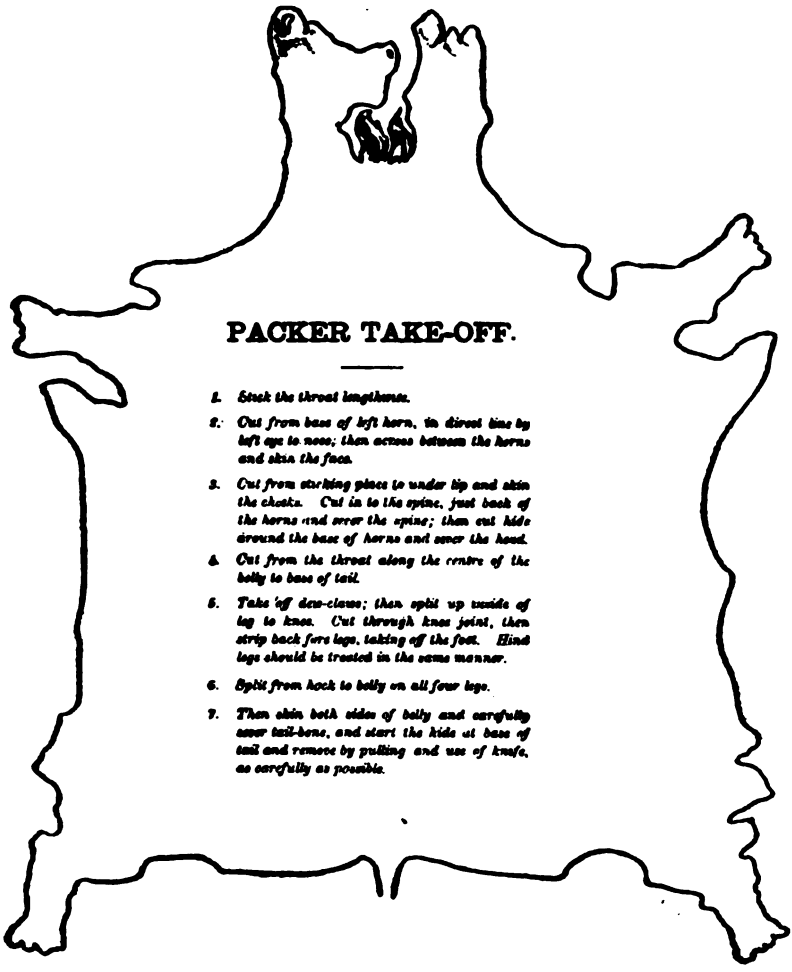
A CHICAGO "PACKER" HIDE.



PACKER TAKE-OFF.

1. *Stick the throat lengthwise.*
2. *Cut from base of left horn, in direct line by left eye to nose; then across between the horns and skin the face.*
3. *Cut from sticking place to under lip and skin the cheeks. Cut in to the spine, just back of the horns and over the spine; then cut hide around the base of horns and over the head.*
4. *Cut from the throat along the centre of the belly to base of tail.*
5. *Take off dew-claws; then split up inside of leg to knee. Cut through knee joint, then strip back fore legs, taking off the feet. Hind legs should be treated in the same manner.*
6. *Split from hock to belly on all four legs.*
7. *Then skin both sides of belly and carefully sever tail-bone, and start the hide at base of tail and remove by pulling and use of knife, as carefully as possible.*

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CAUSE OF SALT STAINS.

The principal cause of salt stains is the using of dirty and blood stained salt in curing the hides. The salt becomes dirty in using it over and over again. Most, or in fact all hide salters, never throw any old salt away, but use it over again and again by mixing fresh, clean salt in with it. If hides are cured only by clean, fresh salt, there is very little danger of them getting salt stained, at least any to hurt. But dirty salt that contains the sweepings of the floor or ground, and thereby some clay, which is one of the very worst things for staining a hide, will accomplish the work of staining. Hides cured in clean, new salt will look white and clean upon the flesh, and hides cured with old salt that has been used once or oftener will look dirty, muddy and dark upon the flesh side. These kinds are the ones for tanners to avoid if they want hides that are not salt stained. The longer hides remain in the salt bed the more likely are they to become stained. Resalting of hides I have found also to be a great cause of stains. Tanners should refuse all hides that they have reason to think have been resalted as they not only are weighted up thereby, but have a tendency to being stained.

Rock salt or salt from mines is a great thing for staining hides, as it contains other minerals, iron, etc., often, which are sure to stain them badly. Salt made from sea water or salt springs, by boiling the water down, will not stain when new and clean. Out of about three car loads of salted hides, I have found as much as 60 per cent. of them so badly salt stained by improper salting or doctoring that the leather had to be finished into harness leather even when not otherwise suitable for that kind of leather, merely on account of the stains, at a great loss. If tanners would insist upon a guarantee that the hides they purchase of dealers were not salt stained, and demand damages for losses where they were, they would break up the improper curing and salting of hides. This is the only way that will prevent it. As long as the hide salters can cure their hides in this careless and objectionable way with impunity they will do it. In large packing establishments where very large numbers of hides are cured, there is not so much danger of the hides being stained, for the simple reason that larger quantities of clean and new salt are constantly used, unless they use the mine or rock salt. To insure hides entirely clear from salt stains, no salt should be used more than once upon the hides.

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Location and Construction of Tanneries.

TANNING GEOGRAPHY.

Can leather be profitably produced in certain sections of the country distant from bark regions?

This question is frequently asked, and is of sufficient importance to receive careful consideration.

Before the advent of extracts of bark or wood, the invariable answer to this question was a "No." It was cheaper to transport hides to the bark and leather to distributive points than to haul bark to cattle slaughtering centers. This state of affairs, however, is now very largely changed, and the change is due more especially to the introduction of a new tanning agent—quebracho—at once concentrated in form and cheap in price.

Besides the question of tanning materials, however, there still exist several important matters for consideration in the selection of a tannery location.

1. Supply of hides and the class of leather for which they are adapted.
2. The distribution of the leather so produced.
3. The supply and quantity of water.
4. The efficiency of labor.

Every section of the country produces hides peculiar to itself and whose characteristics are more or less better adapted for one purpose than another. In many of the Southern states the hides are from small cattle, and badly taken off. Many are branded, fly ticked and damaged by the butcher's knife. Such hides make undesirable leather for many uses. The best of them are employed for light harness and collar leather, as well as for some grades of shoe leather.

It would not, therefore, be economical to tan hides in a section that could not use such leather locally. In other words, it would not be any advantage to buy extract in New York to tan hides in Texas and be obliged to ship the leather for sale in New York. On the other hand, it would be a distinct advantage if hides slaugh-

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tered in Texas could be tanned in Texas and the leather sold and used in Texas.

Looking at the opposite side of the question, hides suitable for sole or upper leather could not be tanned with profit if there were no local shoe factories to buy the product.

Take, for example, Kansas City. Here is a point where vast numbers of high-grade cattle are slaughtered, whose hides might be profitably made into sole or harness leather, provided it could be distributed and used in the west and southwest. With lighter leather, such as calfskins, for instance, the case would be different. Calf leather can be sold in large quantities only in shoe manufacturing centers. A calfskin tannery, therefore, would likely be an unprofitable industry in Kansas City, as the leather would have to be equally good as that made elsewhere or suffer in price.

The cost of tanning heavy leather in sections such as named above, with concentrated extracts, need be little or no greater than in bark sections. A cord of chestnut oak bark runs on the average from 2,000 to 2,240 pounds and leaches down to from 150 to 200 pounds of tannin. Judging from the number of cords of bark that many tanners are using to every 100 hides, it would oftentimes appear as if not much more than 100 pounds of tan out of every cord of bark were actually made available for absorption by the hide—the balance being wasted by unscientific methods of tanning.

It is very clear that tanners in Kansas or Texas, with high rates of freight prevailing both from the bark regions and the seaboard, cannot afford to pay for the transportation of 2,240 pounds of bark in order to get 100 or even 150 pounds of available tan.

If, however, they could secure their 100 pounds of tan in the form of 150 to 200 pounds of extract, the case would be different, provided the extract, to begin with, could be bought for a reasonable price. It is just here that quebracho extract offers such a field for the development of tanneries far removed from a bark supply. A barrel of solid quebracho weighing 300 pounds, or a barrel of liquid quebracho weighing 500 pounds, will contain 200 pounds of tan, and this 200 pounds in the form of solid, if not in liquid, can be laid down today in many of the western hide districts, far from the bark regions, at prices just about as low as many of the bark tanners are paying for 200 pounds of tan in the form of 1½ to 2 cords of bark that must be piled and ground and leached before ready for use.

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The supply and quality of water is very important, but while some few sections having water impregnated with iron or magnesia or lime are entirely unfit for tannery locations, there may be waters a few miles distant that are quite desirable.

Then there is the question of labor. Efficiency is highly necessary, especially in the management and superintendence. Many failures can be traced to technical ignorance, and others to utter ignorance of economics in labor.

Everything, however, considered, the means are at hand, and it is now possible to profitably produce leather in sections remote from bark, providing that hide supply and leather distribution justifies the venture, and provided always that a man with the proper technical skill and ability in the modern use of extracts and management of labor can be found.

Without such a man—keep away from the tanning business.

TANNERY CONSTRUCTION.

Tannery construction that will best meet the requirements of the trade is a subject requiring much study and thought.

In the selection of a site for the location of a tannery may be found a good opportunity for one to exercise his best judgment. Nature has provided many such locations, and if we are only keen enough to look them up, the tanning business can be greatly facilitated and assisted by the aid of gravity in the running of liquors, conveying of bark and the handling of stock generally.

LOCATION.

If the location should be so selected that the bark piles could be placed on an elevation or small table land, say fifteen to thirty feet above the bark mills, and then have the mills located a little above the top of leaches and still keep the leaches six to ten feet above the yard and tannery generally, how nicely the bark and liquors would naturally gravitate to their final resting place.

POWER.

Then if the power is transmitted by electricity, the boilers and engine for generating the power can be located on this general level where the spent bark can be cheaply conveyed for fuel without the use of expensive and troublesome elevators. A location where all of

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these conditions can be complied with will do away with many elevators and pumps; for in fact, there would be no elevating of bark and liquors, except the weak liquors that go back to the leaches.

BARK.

Now let us go back to the bark piles. In many instances they are too much neglected, and a large amount of waste is continually going on there. It is much better to have all the bark piled in leakless sheds, as a pile of bark exposed to the weather and covered with a bark roof will in two years' time waste about one-third of a cord of bark to every one hundred square feet of roofing surface. This on a pile of thirty by five hundred feet (the roof of which would be about forty by five hundred) would amount to 66 1-3 cords of bark at $7.00 per cord, giving us a waste every two years of $464.33, which would in a very short time amount to enough to build a good shed.

It is not only the loss of bark used for roofing, but there is also a loss of about 33 per cent. in the extra power required to grind bark where it is wet with rain and snow in an exposed open pile, more especially during the wet season of the year. This is much more noticeable where the bark is being ground with any mill other than a cutting mill.

One of the most practical methods of delivering bark from the pile to the grinding room is by a railroad of some kind, the cars of which can be drawn by a horse, or a wire cable on a spool driven by a friction clutch. It is also very advantageous to have the track elevated in the bark room and the cars made to dump the bark on either side, which makes a rapid method of unloading.

To meet these advantages it would be necessary in the construction of a bark or grinding room to have it of a proper height and quite roomy.

BARK GRINDING.

The bark grinding room should be in an entirely separate building and kept isolated, as it is one of the most dangerous firetraps about a tannery. In fact, it is far better to have all of the different departments in separate buildings as much as possible.

Many of the grinders used produce a large amount of dust, which, though detrimental to machinery, is yet valuable for liquors. It would certainly be better to utilize it. This saving can be made by having

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tight and well covered conveyors from the mills to the leach house and by introducing a small jet of steam into the conveyor near to the mills.

CONVEYORS.

In the construction of the conveyors to deliver the bark to the leaches it is good economy to have them used for that purpose only, and not used to return the spent bark to the fire room, for a small waste will be constantly going on while the same conveyors are carrying the two kinds of bark at the same time, by the small particles of dry bark sticking to the flights and then dropping off with the spent tan.

LEACHING HOUSE.

The leach house is much cooler and agreeable to work in when there are ten or twelve feet between the top of leaches and the roof; it is also an improvement to have a large ventilator running the entire length through the center of the roof.

The leaches when standing on a good stone foundation do not become useless as soon as they do when placed on a less substantial foundation, which by settling strains the decaying joints and causes them to leak much sooner. Even after the leaches have begun to leak much loss of liquors can be saved by having a cement or clay bottom under them, descending to a tank buried in the ground where the drippage may concentrate, and from there, with a small jet-pump, it can be delivered back to the leaches, or to any place you may want to put it. The leach bottoms should not be less than six or eight feet above the ground or cement floor, which gives ample space to discharge the spent tan from the center of the leaches and also room to move around under them for inspection and to make repairs.

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Soaking, Liming and Beamhouse Work.

SUGGESTIONS FOR SOAKING DRY HIDES.

It is not as easy as it looks to soak and put dry hides through the beamhouse so as to get the best possible results.

Here are a few suggestions: The hides should be soaked in strong salt water or pickled. This may be news to some tanners, but it is a good soak recipe. Run your soak or vat full of cold water, or within two feet of the top, then throw in enough old salt from the hide house to make the water stand 52 degrees barkometer.

Tanners who handle dry hides exclusively may reply that they have no old salt on hand. That being so, they could get a supply from the nearest hide dealer or salter. I prefer old salt because it contains more organic or animal matter than fresh salt and is more likely, therefore, to put the soak water into the required condition for softening and reducing the flint hides.

Before throwing in the hides stir up the soak with a lime plunger so as to dissolve the salt and make the pickle uniform as possible.

After making the soak, let it stand for a few hours, then plunge it again and be sure that it registers 52 degrees, as previously mentioned.

Now, throw in the dry hides and when the vat is full put short planks on top to force all the hides under water and let them lie for at least four days. Then take up and handle and return to the same water, where they should remain for from two to four days longer.

Withdraw and mill the wet hides thoroughly in a pin-wheel and throw them back in same old water for one or two days.

Haul out and put the hides into clean, fresh water, for say two days. Handle up each day, running off the stale water so as to keep the vat afresh. The hides will not be in good workable condition and should be fleshed on the machine and then returned to fresh water for two days longer before liming.

In the limes it is best to use, say, 2½ pounds of red arsenic to each

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lime. Dissolve the arsenic in lime tub while the lime is being slacked so as to get best results. The method just described has been most successfully used in Canada.

Some tanners use a hide mill to complete the softening of dry hides; others prefer the pin mill. For my part, I like the pin mill with long pins, say nine inches long, which will do good work and are much cheaper to put up.

The reason why many tanners have failed to handle dry hides successfully is to be found in faulty soaking.

The salt water suggestion is simple, yet well worth trying. The presence of the salt in the water acts very beneficially on the hides so that they come out nearly equal in condition to green stock.

Be sure to get rid of all the old salt water or pickle from the hides before they enter the limes. You can test the hides by tasting them.

I would state that the soak should be cleaned out every four to six weeks. Do not forget to strengthen up the salt soak to 52 degrees for every fresh pack.

BEAMHOUSE WORK.

All hides and skins of which leathers are made are received at the tannery in one of four conditions—they are either green, green-salted, dried or dry-salted.

Domestic skins and hides are generally green-salted; imported hides and skins are green-salted, dried and frequently dry-salted. In order to produce from the raw stock leather that fully meets all the requirements of the modern leather markets, it is very important that the preliminary processes to which the hides and skins are subjected are carried out in a careful and proper manner.

SOAKING.

The importance of the soaking process, the first through which the hides or skins are passed, is not always clearly recognized. Yet the relations between the soaking and the subsequent processes of beamhouse and tannery are very close and unless the first process is properly carried out the results of the following processes will not be satisfactory. Each of the various kinds and classes of skins requires slightly different treatment from the other classes in the soaks.

The ends and objects to be accomplished during the soaking are (a) thorough softening of the hides or skins, and (b) the removal from

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them of such foreign substances as would interfere with the making of good leather. The stock should be thoroughly softened without being allowed to become flaccid.

Freshly killed and salted cow hides and calfskins if soaked for too long a time lose much of their gelatine, which results in loose and spongy leather. On the other hand, if the stock is not soaked long enough and all the salt is not removed from them before unhairing the grain of the finished leather will show up clouded and mottled. Frequently, too, such hides or skins result in loose and lifeless leather. When soaking salted skins it is good practice to leave them in the first soak of clean, fresh water for a few hours, then to remove them and after allowing the dirty water to run off to replace them in another clean soak.

This procedure not only hastens the softening, but also rids the skins of all salt and dirt in a short time.

The water for green and salted skins should be frequently changed. The salt which accumulates in the water does not act as a preservative, but, on the contrary, serves to cause the loss of gelatine. Again, only skins of like nature, condition and size should be soaked together.

HARD AND SOFT WATER.

Whether hard water is better than soft water is a question. Hides or skins soaked in hard water absorb larger quantities than they do of soft water, and consequently become soft in a short time. It is claimed, however, that hard water containing the salts of lime and magnesia tends to affect the gelatine of the skins. It is certain that different results are gotten in various tanneries by the use of different kinds of water. Skins should not be crowded into the soak vats. Salted skins cannot need long soaking—the length of time depending upon the weight and condition of the stock.

Lightly salted skins need but a few hours' soaking in warm water and about twenty-four hours in cold water. After soaking they should be horsed up and allowed to drain well before being dehaired.

Heavy hides require about forty-eight hours, although no exact nor arbitrary rule can be given, as much depends upon the condition of the stock and the temperature of the water.

All blood, dirt and dung should be gotten rid of in the soaks. These substances becoming dissolved are liable in a short time to putrefy; the putrefication readily injuring the skins.

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For this reason it is not good practice to use soaks over and over for different lots of skins. Old, stale soaks certainly do soften hides and skins in a short time, but ofttimes at the expense of the stock. The putrefaction bacteria that are generated in a foul soak rapidly dissolve hide substance and the result of this is weak and lifeless leather.

Flint-dried skins of course need longer soaking than green or salted skins. These skins having been dried thoroughly in the green state are almost waterproof. Such hides and skins if put into a soak of clean water with no assistant to hasten the softening would suffer deterioration before the process was completed.

Before the hides and skins become thoroughly dried putrefaction often sets in which, although it may not be noticed at the time, will show itself during the soaking process. Then every spot that was not perfectly cured or that was tainted before drying will appear either by the hair coming off, the grain peeling or portions of the hide rotting away. Even when the hides are in good condition the thinner portions frequently decompose before the thicker portions have become thoroughly softened. Owing to the difficulties of soaking dry foreign hides many tanners neglect this class of stock.

When the hides and skins are received in good condition and the soaking is properly carried out very good leather can be made from dried stock.

CHEMICAL AIDS.

In order to hasten the soaking and softening solutions of chemicals are frequently added to the water. Borax, sulphide of sodium and caustic soda give good results. Borax is the most expensive of the three articles. When it is used, from two to five pounds for each 1,000 gallons of water may be used. It should be dissolved in a separate vessel and poured into the soak vat under vigorous stirring. The same quantity of sulphide of sodium may be used, or more as may be desired.

Boracic acid may also be used in the soaks, as it assists in the softening of the hides, and being an antiseptic, prevents to some extent the decomposition and loss of hide substance.

The serious danger in connection with the soaking process is the liability to putrefaction. This may be guarded against by the use of the articles mentioned above, and by keeping the soak vats clean by a frequent change of water. The last named method is contrary to the

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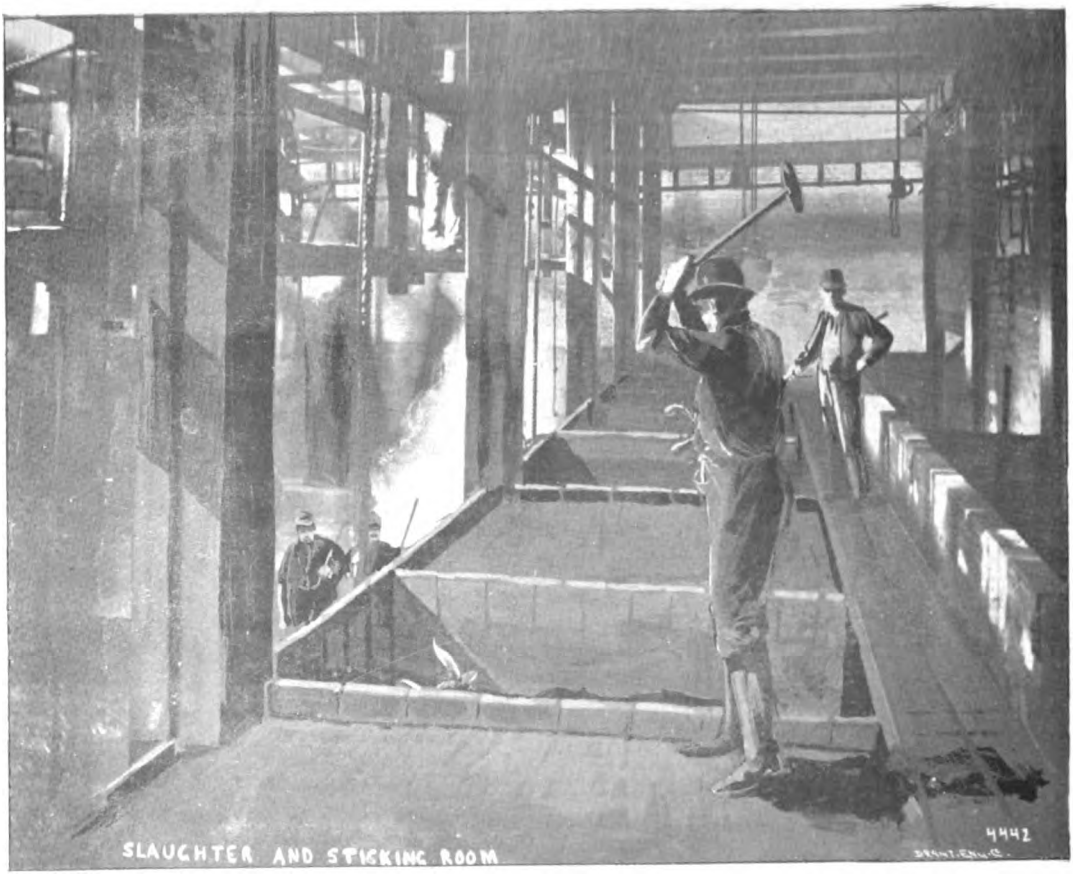

AT THE STOCK YARDS

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practices of many tanners who are in the habit of using foul soaks. If all such would use clean, fresh soaks and if necessary some assistant to hasten the process they would no doubt get better results.

The dirt in the hair of many kinds of skins, especially long-haired goat-skins, sifts through the water, and when the skins are placed in the vat in layers becomes deposited upon the lower layers. In a short time putrefaction sets in and the grain of the finished leather will show up shaded and clouded. This effect will be especially noticeable in light colors. Frequently when it occurs no one can tell what caused it. Improper methods of soaking also often result in pricked or pitted grain; black spots sometimes appear.

"Prick" indicates an appearance similar to what would be caused by puncturing the skins with pins. This is sometimes caused by soaking for too long a time, especially in warm weather. Pitted is an appearance like the above, but the holes are larger. The hides or skins begin to decompose before they are sufficiently softened, which condition causes these injuries and no subsequent treatment can remove them.

SOAKING DRY HIDES.

When soaking dry-salted hides and skins it is good practice to get rid of the salt rapidly. Such hides and skins should be soaked for a short time, then worked mechanically, put back in a clean soak for some time and reworked if necessary.

There is no secret about soaking dried hides and skins other than to watch them and to carry out the process intelligently. Many tanners of green-salted hides for upper and sole leather throw a pack of hides into the soak in clean cold water on one day and on the next day the hides are hauled out and the dirty water allowed to run off. The hides are then put back into another clean, fresh soak for another day. At the end of this time they are removed and fleshed, split from head to tail, pinned together in a long chain and are then ready for unhairing.

UNHAIRING.

When the soaked and softened skins have been removed from the soaks and before they go into the depilating or unhairing process they are frequently piled in heaps. Heating frequently sets in, especially in warm weather, and in a short time the stock will be seriously damaged. Goatskins are especially liable to heat, perhaps more so than other skins, although all skins are very easily affected in this way. When

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heating sets in the skins rapidly decompose and the total loss of the stock can only be stopped by airing the skins at once.

Heating always injures the skins more or less, according to the degree of heat developed, and it is therefore very important to guard against loss in this way as much as possible. The skin pile should be handled frequently, or, better still, no delay should take place, but the skins passed rapidly along to the next process.

In all the beamhouse processes it is good practice to handle the stock promptly. Light dried skins, such as goat, kangaroo and calf skin, need to be soaked from forty-eight to ninety-six hours, depending upon their thickness and the temperature and condition of the water. Good judgment must be exercised here as in all other processes and will go further toward getting good results than any fixed rule. Instead of draining the skins before unhairing they may be passed through the hydro-extractor, by which the water is taken out of them.

When sheepskins are being processed, as these skins are always painted on the flesh side with the depilatory solution, it is good practice to get as much of the water out of them as possible.

Hair skins, which are often immersed, do not require such thorough extracting; however, it is a good plan to rid them of as much water as possible in order to get rid of the salt and dirt.

The cleaner a hide or skin is when going into the depilatory the clearer and brighter will be the grain of the finished leather.

DEPILATORIES.

The office of any material used for the purpose of removing hair or wool from animal skins is to swell and distend the fibers, thus loosening the hair roots and enabling the tanner to readily remove the hair; then to dissolve the perishable animal matter of the skin so that it can be readily removed before tanning. When this has been done leather can be made, and not until then. Various materials are used and different methods are followed in the manner of using them, depending upon the kind of skins and the sort of leather to be made from them.

Years ago the only depilatory in general use for all kinds of hides and skins from the heaviest hide to the finest kid skin was lime. Its use, unless combined with some other article, has many objections. During the last few years sulphide of sodium has come into very general use. It is used either alone or in conjunction with lime. Lime alone acts very slowly, and unless strong solutions are used before it

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has time to fulfil its mission, the hides or skins are apt to suffer deterioration.

The action of lime upon raw skins is swelling and dissolving, and much gelatine or skin substance is lost when lime is used alone.

On the classes of hides and skins intended for leather in which softness and pliability are essential qualities, the action of lime is to dissolve the animal matter of corium faster than it distends the fibers—the result is loose, spongy leather, with a loss of weight and substance. If the skins are not limed long enough to dissolve all the coriin, the resulting leather will be flat and hard.

SULPHIDE OF SODIUM.

Sulphide of sodium overcomes these objectionable features of lime. This material, when properly used, will loosen and split up the fibers, thus loosening the hair or wool in a very short time, and it will not dissolve as much skin substance as lime. When used in conjunction with lime a very satisfactory process is obtained which results in the skins being dehaired and swelled in much less time, and in a much better manner than when lime alone is used. It can be used upon all classes of hides and skins intended for all kinds of leather.

When sulphide of sodium is used alone and no lime whatever is used, the leather comes through lacking in softness and elasticity. Sulphide of sodium is very simple and economical to use, besides producing far better leather than by the old methods of unhairing. No great harm can come to the stock by using it in too strong solutions; the material is merely wasted.

It is important that the sulphide be of good quality, and contain no dirt sediment or iron. The material should be dissolved by boiling water or steam and reduced to liquid form by being dissolved slowly. The solution should be stirred up and not allowed to settle, as the settlings are an important part of the material. It should not be used warm, but should be dissolved long enough beforehand to enable it to become cool.

The strength at which it should be used varies according to the kind of stock to be unhaired. The strength for salted skins, bucks and Merinos, 20 to 24 deg. Baume; thin, open or coarse wool skins, 14 to 18 deg.; milk lambs, 18 to 24 deg. For goat, calf and kid skins, the same strength may be used as for sheepskins. In all cases the strength

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need never be greater than just sufficient to start the wool or hair, It may be used in various ways.

Sheepskins are painted on the flesh side with the sulphide solution, or lime may be mixed with it.

Hair skins and hides may be painted in the same way on the flesh, or on the hair side, or they may be immersed for some hours in a sulphite solution, washed and them limed, or the lime may be mixed with the sulphite in the vats.

When skins are to be painted they should be thoroughly soaked and softened, freed of all salt and dirt, and thoroughly drained or extracted before treatment.

The skins are spread on a smooth table, and the depilatory solution or mixture is applied to them. The liquor is applied with a vegetable fiber brush and only enough liquor is put on to cover the skin without running off. The painter must wear rubber gloves, or his hands will get sore. After painting, the skins are folded up and placed in a pile.

Sheepskins are painted only on the flesh side and folded with the wool out. If any of the sulphide of sodium comes in contact with the wool it attacks it at once and dissolves it.

In cold weather eight to ten skins may be put in a pile together, but in warm weather not more than four or five, and if they are to lay for twenty-four hours or longer they should be singled out so that one may lay on the next and so on.

The painting should be done in a cool, moist room. In summer care must be taken that the skins do not heat, and in winter that they do not get frozen. The hair or wool will be loosened in a few hours, but it is better not to unhair or pull the skins until the next day. The wool or hair will then come off cleaner and easier.

Milk or young lamb and kid skins should be pulled or unhaired as soon as the wool or hair starts, and immediately put into clean, cold water. In pulling sheep pelts, it is bettter to pull them double as they come from the painters, for in this way the wool only is exposed, and there is less danger of injuring it. After pulling, the skins should be opened flesh side out and at once dropped into clean, cold water, in which they will be safe from heating and spoiling for some time.

No skin treated with the sulphide of sodium will be injured so long as the grain is kept moist and not allowed to dry out and harden. The skins should not be exposed to the air any more than is absolutely necessary.

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LIME AND SULPHIDE.

When lime is mixed with the sulphide of sodium it should be reduced to milk of lime by thorough slacking before using. Hot water is used for slacking and the lime should be stirred from the time the water and lime are brought together until the lime is completely slacked. Too much care cannot be taken in this particular. Very often particles of unslacked lime come in contact with the skins and injure them.

About one-third to half a barrel of lime should be used for about fifty gallons of water. After slacking, the solution should be allowed to cool and be used at the consistency of thin paste. The lime may be mixed with the sulphide of sodium in any proportion—there is no hard nor fixed rule. Several pails of lime may be mixed with a barrel of sulphide in solution. When mixed with lime the sulphide of sodium enters into chemical combination with the lime, forming various mixed sulphides, which have a very energetic action upon the skin. The mixture does not swell the skins to the same extent that lime alone does. It sometimes produces a coarser grain and at the same time it does not take so much life out as lime does.

ARSENIC AND LIME.

Red arsenic, if mixed with lime during the slacking, also exerts a very energetic action upon the skins. It produces results practically similar to lime and sulphide of sodium, but on some skins gives a finer grain with more gloss. The mixture of lime and sulphide is applied in the same manner as the liquor made from the latter alone. In some hair skins, where no value is placed upon the hair, the skins may be depilated by leaving them in a solution of sulphide of sodium in a vat.

To each 100 gallons of water from 10 to 15 pounds of depilatory are dissolved and poured into the vat and the mixture is thoroughly stirred. The skins are put into this liquor and left there from twelve to twenty-four hours, or until the hair is reduced to pulp and can be easily washed off. They are then removed, washed and limed. When this method is used it is not so important that the skins be thoroughly softened before going into the solution. They can be left in the solution for from twenty-four to forty-eight hours, until they are thoroughly softened and plumped.

No matter what method of using sulphide of sodium is employed it should be borne in mind that the stronger the solution used and the longer the skins remain in the solution and the less the depilatory is

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washed out after depilating and before liming the weaker and less liming will be necessary.

On all classes of skins sulphide of sodium softens the skins and removes all scruf and filth; also the short hair commonly called the undergrowth. By its use, too, the time of liming is considerably shortened. Calfskins intended for upper, enamel or patent leather should be painted with the same strength of liquor as goat and sheep skins. They can be painted on the flesh side and unhaired as soon as the hair starts; or, if the hair is not to be saved, they may be painted upon the grain side. The hair usually starts in a few hours, depending upon the thickness of the skins and the strength at which the liquor is applied. When it is desired to save the hair it should be well washed as soon as taken off and spread out to dry.

Dry foreign skins, whether they are sheep, kangaroo, goat or calf, must be thoroughly softened and brought back to the natural condition of pliability before they are painted.

HORSE HIDES.

When horse hides are being unhaired two strengths may be used. A liquor of about 20 degrees strength may be used on the fore part, and a 24 degree solution used upon the shell, either clear or mixed with lime. By using it in this way the shell is made softer. One man can put on the strong liquor and another man the weak liquor. The hides can then be further plumped by being left for some hours in a weak sulphide liquor.

Heavy hides intended for sole leather should be thoroughly soaked and then unhaired as promptly as possible, and in such a manner as not to affect the weight of the hides, so as to remove substance or to impair the strength of the leather. Some tanners, usually they are the most progressive, use strong limes and reel the hides frequently from one lime to another, being careful at the same time to plunge the lime well up in the vats. Sulphide of sodium may be mixed with the lime, and when this is done the process takes from two to three days, sometimes less, and the hides are then withdrawn and unhaired.

When no sulphide has been used and the hides have been limed only for two or three days the hair generally comes off with some difficulty. Very little hide substance has been lost and the tanner will consequently get good weight in his leather. Sometimes hides are

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limed for only thirty-six hours and are then put into warm water for from twelve to fifteen hours.

SOLE LEATHER HIDES.

In sole leather weight and solidity are prime requisites and loss of hide substance is guarded against by short, quick unhairing and liming.

When the hides are removed from the warm water they are worked over the beam and are then again put into clean water in order to cleanse them from the dirt, scruf and grease. The beam work, when carefully done, results in bright, clean, smooth stock. The results gotten with sulphide of sodium used on hides for sole leather are greater weight, finer, closer grain, exceeding toughness and strength, and a great saving of time, anxiety and labor.

One method of using it is to spread the hide on a smooth surface, hair side up, if no value is placed on the hair. The sulphide of sodium is reduced to a liquid of about 18 degrees strength and may be used alone or it may be mixed with lime, using about three parts lime and sulphide liquor one part. A vegetable fiber brush or a swab made of common sacking or burlap may be used in putting on the liquid. The liquid is spread evenly over the entire hide and every spot covered. The hide is then folded up with the painted side on the inside and covered up so as to keep out the air and to prevent the paste from drying.

If it is desired to save the hair the hide must be painted on the flesh side and the hair kept clean. The hides should be kept in a cool, moist room until the hair starts, after which they should be washed in cold water and unhaired in the ordinary manner. The hides are fleshed and the grains finehaired. A light liming for a few days can then be given the hides.

Another method of unhairing heavy hides is as follows: A vat is filled with sufficient quantity of water and one part slacked lime and one part dissolved sulphide of sodium is mixed into the water and the hide put in. In from twelve to twenty-four hours the hair will readily come off and the hides may be removed from the vat and unhaired.

When this method is employed it is necessary to use stronger liquors in tanning. Prolonged liming will cause the leather to be loose and spongy, very undesirable qualities in sole leather. After unhairing, nothing further need be done to the grain, as it will be found to be very soft and clean.

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UPPER LEATHER HIDES.

Hides intended for any kind of upper leather can be unhaired in any of the methods described above and with the same strength of solutions as other hides and skins. After unhairing a further liming and swelling will be found necessary, depending upon the kind of leather to be made. The length of time necessary to lime heavy hides will be considerably shortened by the use of sulphide of sodium. The lime can be weakened or strengthened as circumstances demand. When the water is hard it is necessary to use more sulphide than for soft water. Hides may be swollen, unhaired and limed in from two to four days, depending upon the condition of the hides and the strength and temperature of the liquor.

Light skins, such as sheep, calf, goat and kangaroo, after unhairing or pulling in any of the methods described, are limed for a short time in order to give to the leather greater softness and elasticity.

While sulphide of sodium is an excellent unhairing agent the mere removal of the hair or wool is not all that must be accomplished before good leather can be made.

THE USE OF LIME.

The skins, after depilating, must be further swollen or plumped in order to accomplish the dissolution of the animal matter in them. Lime not only does this, but it also unites with the yolk or fatty matter of the skins to saponify them, so that the dissolved substances can be removed from the skins before they are subjected to the action of the tanning liquors.

Many good tanners use what they call gathering limes. This is good practice only so long as they are kept clean and sweet. When limes are used over and over it takes new lime to strengthen the old lime ground, and unless the limes are kept clean and fresh the leather will never be clear and bright looking. The solvent action of an old and a fresh lime is about the same, but the swelling property decreases with age.

The first lime in which the skins are placed may be half renewed for each pack of skins by running out about one-half of the liquor and replacing it with water. This applies to limes that have been used for previous packs.

When it is necessary to make a new lime about two buckets of lime are slacked in about one-third of a barrel of water. This is panned

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into the vat and will answer for from 300 to 400 skins, according to their size.

This first lime should always be kept clean and fresh and should not be used too long.

In summer it should be used not more than three times; in winter twice as long. The slats may remain in this lime from one day until the next, then hauled out and more lime may be added or the skins may be put into another and stronger lime. Upon the third day the skins are again hauled out and more lime added and the lime thoroughly stirred up from the bottom of the vat.

From four to six days is long enough to lime light skins. If they are to be tanned without pickling a little more lime may be used and will do no harm.

If paddle vats are used for liming it will keep them in constant motion. The liming will also be accomplished in less time than where still limes are used. When the latter are used the slats should be hauled out daily.

Lamb and kid skins need to be limed three or four days in summer and four or five days in winter.

In all instances the best results are gotten when skins are entered into a weak first lime and the lime gradually strengthened.

Where vat room is scarce it is good practice to haul the skins out after liming for four or five days and to let them lie in piles for a few days. They should be protected and not allowed to dry out. A great deal depends upon the size and condition of the skins, time of the year and temperature of the water, hence no hard and fixed rule can be given. When sulphide of sodium is used in connection with the lime the lime will be rendered more soluble and therefore more easily removed by washing.

After liming the skins are washed in clean water in order to remove as much lime as possible; then trimmed, short haired and fleshed, and are then ready for the drench.

For some classes of skins intended for soft and elastic leather, such as glove material, softness and elasticity are partly obtained by long liming and low drenching. The animal matter or casein is dissolved and also some of the skin fibers are attacked, with the result that the leather comes through very soft and stretchy. This condition is desirable in glove leather, but very undesirable in all classes of shoe upper material. The process must not be carried too far, as this would result in weak-

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ening the fibers to such an extent as to impair the strength of the leather.

Owing to the small amount of plumpness produced by chrome liquors, skins intended to be tanned in such process must be processed through the beamhouse in such a manner as to guard against loss of substance as much as possible.

The quality of the finished leather is largely determined by the methods employed in the beamhouse, and if these processes are not carried out in a careful manner the evil effects will show up in the finished product.

ERRORS IN THE BEAMHOUSE.

Many of the defects met with in finished leather, such as coarseness and roughness of grain, looseness and sponginess or the opposite of this condition, that is, close, tight textured skins, are caused by improper and careless methods of liming and puring. If leather, after having proper care in tanning, is flat and tinny it can be usually relied upon that the skins were not limed long enough; or if the grain is drawn or the skins are spongy they have been limed too much.

Frequently a clouded and mottled appearance of the grain is caused by salt having been left in the skins, or the grain was exposed after unhairing and before liming, or the skins were not properly opened out and handled in the limes.

Sometimes skins after tanning have hard black or brown spots. These may be caused by improper soaking and preparation of the skins before painting, or the skins while being processed through sulphide of sodium and lime were brought in contact with iron.

If it is possible a copper or composition pipe should be used when dissolving the sulphide. All iron should be kept away from it.

No subsequent treatment can cure the damage done to skins by carelessness, ignorance or abuse. Skins intended for glove leather can be best unhaired by using red arsenic mixed with lime, as this material gives a fine, smooth and elastic skin. Its use is also desirable on goatskins intended for glazed kid. Lime alone gives considerably more spread to the skins than other materials.

It is necessary when processing sheepskins to rid them of as much grease as possible. The skins are usually pressed after liming between strong presses, they being sprinkled with sawdust to prevent their slipping.

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BATING AND PURING.

The excrements of hens, pigeons and dogs have been used for many years, and while their use is unpleasant in the extreme and attended with many dangers, for some classes of skins they produce results that no other material seems able to produce. On calf, sheep, kangaroo and hides and kips their use may be dispensed with and other materials used that produce good results safer and at less cost. On goatskins for glazed kid nothing gives quite the same results as dung when it is used in a proper manner. As the dung puring is still largely used on goatskins and also on other skins we will describe the process.

Bird dung is very rapid in its action and makes the skins very silky and the leather tough, but without much spring. On the other hand, dog dung has a very softening action, but produces a hollower leather with more spring to it.

Before it is wanted for use the dung should be kept spread out on a dry floor to prevent its heating. To get the best results the dung should be gathered while fresh and then dried for future use.

Great differences are found in the manures gathered from various poultry raisers, depending largely upon what the birds have been fed. Chicken manure containing a percentage of dog manure will be found to be of greater strength.

Chicken manure gathered during the winter months does not dry when dropped, as it does in summer, but freezes and thaws, and thereby loses a good proportion of its active properties. When making a manure bate one bushel and a half of the material is put into a clean barrel, the barrel is filled rather more than half full of water and by the aid of steam the temperature is raised to boiling point.

The mixture should be stirred until it is broken up fine; then the barrel is covered and the stuff allowed to ferment. Pure water should be used for this purpose. A paddle wheel vat is filled with the necessary amount of water and this is raised to a temperature ranging from 90 to 95 degrees Fah.

DANGER OF BURNING.

In order to avoid burns and stains upon the skins, caused by masses of undissolved excrement resting upon the grain or lying between two skins, the material should be strained through a piece of bagging or burlap. The skins or hides are thrown into the vat and by the action of the paddles are kept in constant motion. The stock is processed

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until such time as the lime has become neutralized and the skins have been reduced from their former rigid and swollen condition to one of mellowness and the grain has acquired a smooth, silky feeling.

The action of the pure is principally due to bacteriological action. By drawing the thumb and the forefinger across the body portion the condition of the stock may be readily ascertained or it may be also discovered when the indentation of the finger nails can be plainly traced on the grain. No stated time can be given for processing the stock. The judgment of the operator must decide this. For this reason and for many disturbing influences over which the operator has no control, the use of dungs for puring is dangerous and risky. Constant attention must be given the stock, so that the depleting is not carried beyond a certain stage. Several kinds of bacteria are generated and unless the matter is closely attended to the wrong kind of bacteria will be generated.

PUTREFACTION.

The common bacteria of putrefaction are the worst kind, and when they once set in the resulting leather will be flat and lifeless, owing to the fact that the interlocking fibers have been attacked and destroyed. A very few minutes after the stock is reduced to the right point, putrefaction will set in, first showing on the flesh side, which will commence to peel off by a gentle touch of the fingers.

The turning of the pure cannot always be discerned until considerable damage has been done to the skins. They change color, turning first blue and then gradually darkening. The grain becomes afflicted with minute pin holes known as bate pricks. They are easily discernible and although they are very small they destroy the skins for grain leather purposes or at least reduce its value. Owing to its liability to putrefy a fresh pure should be made for each pack of skins.

By carefully observing and giving strict attention to the matter the faults are less liable to occur and very good results may be gotten with manures.

It is essentially upon the swollen hide substance the pure works. It liquefies a portion of the skin substance and this together with the lime and lime water oozes out of the skin in the form of a colorless liquid. The pelt thereupon becomes soft and silky. The slimy liquid is readily removed after puring by slight beamwork or by washing in warm water.

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ACID BATH.

With goatskins it is necessary to give them a further treatment. The skins are taken from the puring vat and given a thorough working on the grain by means of which the scud hair roots, lime, etc., are forced out of the pores of the skins. When this has been done the skins are placed in a weak lactic acid bath, by which they are further cleaned and their neutral condition is assured before going into the tan. To each 100 gallons of warm water in a paddle vat about one-half gallon of acid is added. The skins are processed in this bath for from thirty to forty minutes, removed therefrom, washed off in warm water and are then ready for tanning.

The working of the skins by mechanical means may be dispensed with and this acid bath used at a temperature of 90 degrees will accomplish the same result. Goatskins, owing to their hard, close grain, require and will stand a much lower drenching than almost any other skins.

To accomplish rapid tanning the skins must be perfectly clean and neutral before going into the liquors. This is especially true of chrome liquors by which nearly all goatskins are tanned today.

In order to get colors right the skins must be perfectly clean. Much of the dyer's troubles would be abolished if the skins were cleaned more thoroughly before being tanned.

The puring and drenching should always be done at a temperature near 90 degrees Fah. The use of too warm liquors will burn the skins, shrinking them and causing the grain to be harsh, rough and raised.

DRENCHING.

One of the oldest and most widely used methods of drenching skins is by the use of the bran drench. In fact many tanners consider this and manure drenching the only methods of cleansing skins.

It is impossible to give any fixed rule for this process as good judgment will go further toward getting good results than any fixed rule. In some tanneries where old sour liquors are to be had a bucket of bran is used for each 100 skins in enough old sour to allow the skins to process nicely. The liquor is used warm, about 90 degrees, and the skins are left therein over night, then a new drench is prepared. One and one-half buckets of bran are used for each 100 skins in enough warm water and the skins are left in this drench from twelve to eighteen hours in warm weather and from twelve to twenty-four hours in cold weather,

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after which they are scudded or worked on the beam and washed in clean water and are then ready for the pickling or tanning process. Another method is to use about 200 pounds of bran for each 600 skins medium size. The temperature of the bath should be in summer about 90 degrees and in winter it may be a few degrees warmer. About one-half of the bran is put into the water and then stirred well. Then about one-half of the skins are put in. Before they are put in it is good practice to let them lay for an hour or two in warm water. After the skins are put in, the drench should be thoroughly stirred, then the balance of the bran in and then the remaining skins.

The action of the bran is due to the fermentive action developed; and the process requires considerable attention. The grain of the skins frequently becomes rough and shady in the bran drench and the leather thus affected cannot be put into fancy colors.

Frequently, too, when the fermentation is not fully developed, or the drench used too hot, too long or too strong the leather will crack in the finishing. The length of time during which skins are usually left in bran drench varies according to the amount of lime present and to the perfect or imperfect development of the drench. Usually it requires, including the time consumed in developing the bath, from twelve to twenty-four hours. In summer it takes less time to get the skins well worked down than in winter.

After the skins are drenched to the proper condition they are removed from the drench and well washed in warm water for twenty or thirty minutes and worked on the grain side. After this the skins are ready for tanning or, if they are sheepskins, to be pickled. The pickling solution or process liquor is composed of salt and sulphuric acid in water. The strength is a matter of judgment; it should be a sharp sour liquor with some taste of salt. About 2½ quarts of sulphuric acid and 50 pounds of salt is a good receipt. This is enough for 100 skins.

PICKLING SKINS.

When putting the skins into the pickle care must be taken to open each skin out and to enter them singly and to stir them well. They should remain in the liquor for from six to twelve hours, being all the time stirred about by the paddle wheel. They are bleached and preserved by the pickle. The chlorine freed by the union of the acid and salt bleaches the slats. The pickling tub should be run off and

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cleaned out about once in two months. Skins that appear fluffy or like tripe after drenching have not been properly worked down. Skins that are rotten and crack after pickling have been worked down too low in the drench. As the drench sours gases are formed and the skins are forced up on the surface. It is necessary to keep them down in order that they may drench evenly. The active agent in the bran drench is lactic acid.

In warm weather the skins need to be carefully watched as butyric fermentation takes place in a short time, with the result that much skin substance will be destroyed and the skins seriously damaged.

PATENT BATES.

Many compounds have been proposed as substitutes for manures and bran. Some of these have proven successful in careful hands and are gradually growing in favor. Several patent bates are on the market, by the use of which the objectionable features of manures and bran may be done away with.

It is not an uncommon practice among tanners of sole leather to wash the stock in water after unhairing, before proceeding to tan it in the tanning liquors, then to depend upon the acids in the tan liquor to expel what lime remains. A slight washing may be given, but not enough to impair the weight of the hides or to remove hide substance.

In the manufacture of acid sole leather the hides or sides upon coming from the limes are unhaired, beamed and washed, and are then thrown into a more sour liquor. They are left in this for about one-half hour. The sides are then transferred to the acid vats. These consist of water and sulphuric acid, about one and one-half pails of acid being added to 900 gallons of water. The liquor is strengthened at the end of 24 hours by adding another half-pail of acid. The water and acid should be well plunged up each time before putting in the stock. The time consumed by the acid treatment is usually about 48 hours. The methods of handling hides of course vary with every manufacturer and according to the class of leather to be made.

On all classes of shoe and glove leather where softness and pliability are required the dissolved animal matter must be removed before the stock is tanned. In the case of sole leather, however, where firmness and solidity are essential they must be allowed to remain, as they unite with the tannin to form leather. Light skins lightly lined may be

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drenched and cleansed by the use of borax or boracic acid. They work out the lime without attacking the skin substance.

LACTIC ACID.

As mentioned in the description of the bran drench, the fermentation of the bran causes various organic acids to form, chief and most important among which is lactic acid. Indeed, it is this acid that is the active agent in the bran drench which neutralizes and removes the lime from the skins. It is not strange, therefore, that the pure lactic acid should be used for deliming purposes. Its use is very simple and safe. There is no objectionable smell, and more than enough may be used without injuring the skins. It is useful in various ways, for instance skins that have been puring in a dung bath may be given an additional drenching of lactic acid, by which their perfect condition is assured before going into the tan liquor.

For calf, kip, sheep and kangaroo stock intended for shoe purposes and for all classes of skins intended for glove leathers, whether black or colored, it may be used in the following manner: After the skins are removed from the limes they are washed in water, preferably warm, in order to remove from them as much lime as possible. A paddle vat or reel is now made up with the necessary quantity of water heated to about 95 degrees Fahrenheit. To each 100 gallons of water in the reel one gallon of lactic acid is added. The amount of acid necessary depends somewhat upon the amount of lime present, and may be varied to meet the requirements. As a rule this quantity will be found sufficient. The skins may also be weighed, and to each 100 pounds of stock about two pounds of the acid may be used. A warm drench serves to not only remove the lime in a short time, but also to bring down the skins, making them thin and soft, while a cool bath, while it will remove the lime also satisfactorily, will leave the skins plumper, which condition is especially desirable when the chrome process is used.

The skins are entered into the bath and the paddles are set in motion. After running for about an hour the skins will be found to be sufficiently drenched to be removed and given the usual working. Skins drenched in this manner will be found to bear a much harder working on the grain than when manures are used. After the working, the skins may be put back into another drench prepared the same as the first and left therein for one hour in order to still further neutralize the lime and to remove any dirt acquired by the skins during the

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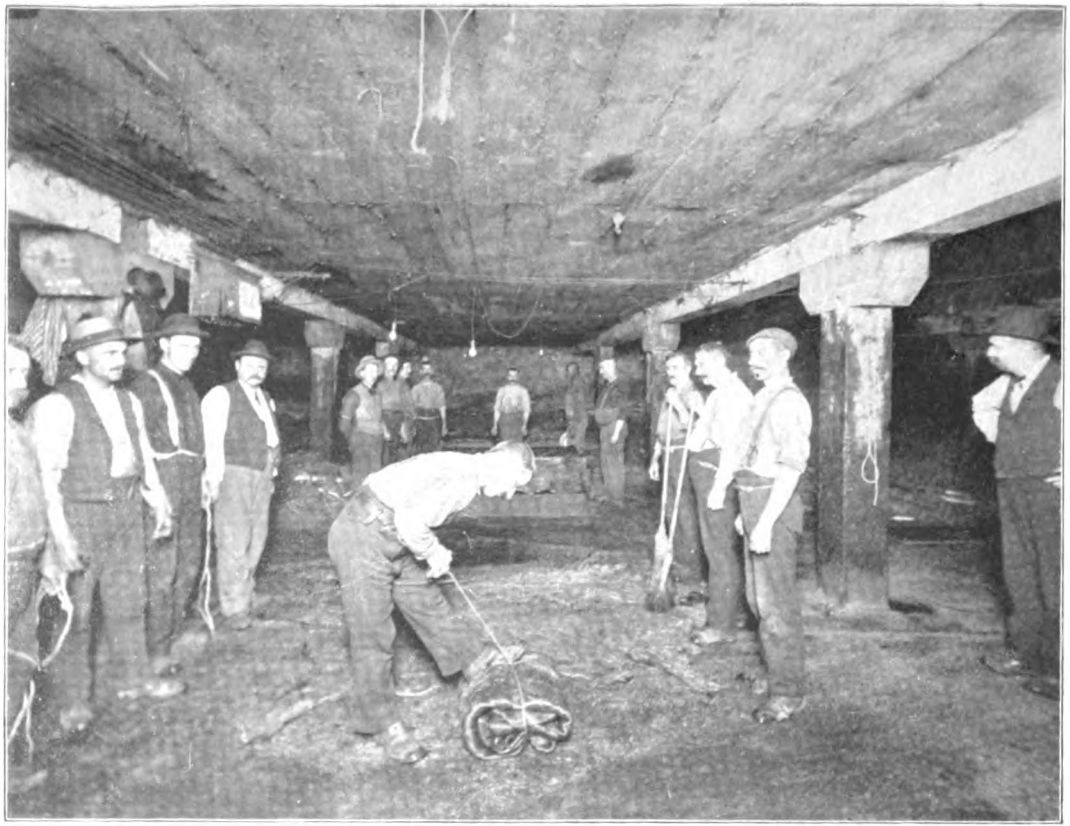

BUNDLING HIDES FOR SHIPMENT.

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beamwork. After the second washing the skins are ready for tanning or pickling without further washing, although when the chrome tannage is used it is probably best to wash the skins a little in warm water before tanning them.

In continuous practice the next lot of skins can be entered into the second bath and the first one thrown away. A fresh drench should always be used for the second process. For sheepskins a little less acid may be used than for other skins.

Mocha skins intended for glove purposes, which on account of their nature are not bated, can be very satisfactorily prepared by the use of lactic acid.

All classes of skins can be processed in paddle vats or drums. Doubtless the paddle method is best. If a drum is used a half-hour drumming will be found enough, and less water is used than when other methods are employed.

The methods of using this article may be varied to meet different needs and results, but no harm can come to the stock by using too much or by leaving the skins in the liquor longer than is necessary.

BEAMHOUSE NOTES.

Absolute cleanliness and freedom from lime and other impurities is a great help to rapid tanning and good results in coloring.

Alligator and similar skins should not be bated, but merely drenched with lactic acid, by which the natural formation of the hides is retained. The grades of lactic acid upon the market seldom contain any impurities that are likely to be detrimental to the use of the acid.

Heavy hides can be nicely prepared by the use of lactic acid by using about two pounds of acid for each 100 pounds of stock, and by working the hides through in the same manner as described above. Instead of working hides intended for sole leather in an old or spent tan liquor, it will be found that good results can be gotten if they are treated in a bath of lactic acid, owing to the latter's efficacy in removing the lime without affecting the tissues or fibers of the hides. Two and a half per cent of the weight of the hides should be sufficient and the temperature about 85 degrees Fahrenheit.

Skins tanned by any of the well known vegetable processes frequently show dark spots and a brittle grain. These are caused by the presence of lime in the skins. When skins are tanned in chrome liquors and lime is left in them, sulphate of lime is produced, due to the acids

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uniting with the lime. This produces a hard, brittle leather, with no give nor elasticity.

To sum up, goatskins are best prepared for tanning by being pured in a manure pure, followed by a light drenching in lactic acid. Calfskins may be prepared in the same way, or they may be drenched with lactic acid alone. Shepskins may be drenched with bran or lactic acid.

Many of the defects met with in finished leather are caused by improper methods of drenching. The colorman's troubles will be greatly lessened if hides and skins are thoroughly pured and drenched. Too great care cannot be taken in the puring process, as it is one of the most important processes with which tanners have to deal.

Much more might be written upon the methods employed in the beamhouse, but the purpose of the writer was to give in as brief space as possible a general description of the more common practices, and to give such practical hints and suggestions as would enable the leather worker to fully understand a few of the most important processes.

Methods, of course, vary, but any intelligent beamsman can, by carefully following out any one of the methods here described, produce stock that he may be proud of.

A BEAMHOUSE EXPERIMENT.

The following experiment, which is selected as being fairly representative of a number of similar character, was undertaken with a view of ascertaining just how much of the hide bought reaches the point where it is ready for tanning.

This, it is true, can be learned in a tolerably accurate manner by weighing a given number of hides in the hide house and again just before going to the liquor, the water held by the hide being determined, the rest is a simple matter of calculation; but it was considered important as well as interesting to find out how much offal and loss there was in each beamhouse operation and process. No attempt whatever was made at economic or improved methods; the hides were simply treated in what may be called the old-fashioned way, by a tanner of some thirty years' experience, it being only our mission to follow him in his work and ascertain the facts herein given. The hides being intended for the production of heavy leather, the results more particularly apply to that class; we would, however, call attention to the fact

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that from figures obtained on light hides of different grades, treated in the beamhouse by more modern methods, we find the difference is not so great as appearances in the hide might imply.

The greatest factor of variation is due to the time of year the hide is taken off; the next is that of variation in the beamhouse processes themselves. The first, being a matter of nature, is beyond the control of the tanner; with regard to the second, a little study of liming as carried out in the test will show how easily variations in the amount of hide to tan are made by the tanner himself.

For the experiment nine hides were carefully selected from a lot of packer steers of average condition, the idea being to get them as nearly alike as possible in weight, spread and texture, as it was the intention to divide them into series during liming. The number of hides was thus limited in order that comparative results might be obtained.

To have a much greater number would have introduced hides of widely varying character, thereby materially affecting the accuracy of the data desired.

The total weight was found to be 612 pounds, an average of sixty-eight pounds per hide. They were then divided into series of three each and marked Nos. 1, 2 and 3, respectively.

	Pounds.
No. 1, weighing	205
No. 2, weighing	210
No. 3, weighing	197

Before commencing the actual beamhouse work samples were taken from all over each hide by punching out small pieces one-eighth of an inch in diameter, due care being taken to get just such a quantity of hide in the sample from each part of the hide as that part bore to the whole; in short, the samples as nearly as possible represented the entire hide. The samples were weighed and dried at 212 degrees Fahrenheit until all the water was driven off; reweighing proved the green salted hide to hold 220.32 pounds of water, or 36 per cent., thereby leaving 391.68 pounds of dry hide. It is, perhaps, as well to explain before going further that, as all the offal and loss had to be determined in a dry condition, we are obliged to figure the hide in a similar state in order to prevent confusion or misapprehension later on. By dry we mean as entirely free from water as is possible at a temperature of 212 degrees Fahrenheit.

SOAKING.

The soaking was accomplished in a shallow square tank—deep

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enough, however, to admit of an ample excess of water—and extended over a period of seventy-two hours (three days), fresh water being used each day.

Every twenty-four hours the hides were drawn out upon a grating and drained until all dripping had ceased, the drainage being conducted back to the vat. The water was carefully measured, well stirred and a large sample taken for the determination of the residue it contained. This procedure was repeated on all three days of soaking, and at the conclusion the loss was ascertained to be as below:

	Pounds.	Per cent.
First day, dry residue	118.324	or 30.21
Second day, dry residue	25.690	or 6.56
Third day, dry residue	5.280	or 1.35
Total loss	149.294	38.12

From the above we find, at our first step, that for each 100 pounds of hide bought 38.12 pounds of it finds its way, as it does in most instances, to the sewer.

An examination of the residues showed that in the first soak it was principally manure, salt and earthy matter; in the second the insoluble and soluble matter was about equally divided, while in the third the residue was almost entirely soluble, and no doubt came nearer being unnecessary loss than the soluble matter contained in the other two soaks.

After two days' soaking the hides were worked over on the beam with a dull worker for the purpose of breaking up any hard spots that might be found. There was no trouble on this account, however. The fluid, dirt, etc., was drained back to the vat and included in the residue from the second day's soaking; the shreds of flesh and fatty matter were carefully collected, dried and weighed. This was found to weigh 6.23 pounds, or 1.59 per cent.

The water used was from comparatively shallow wells and very hard in character, being highly charged with lime carbonates; it possessed, however, the redeeming feature of a low temperature—viz., 55 degrees Fahrenheit—which tends to reduce solubility of hide substance and check to some extent the increase of destructive bacteria.

During the course of soaking, the water from each soak was examined for the presence of bacteria, attention being given principally to those which possess the faculty of destroying hide tissue. Such germs were found present in vast numbers during all three days.

By inoculating a small quantity of gelatine with a drop or two of

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the water and allowing them to develop for twenty-four hours we were able to separate out seven varieties which showed marked evidence of decomposing the gelatine. By culture and isolation two of these were found capable of reducing to a liquid, and thereby decomposing ten grams or about one-third of an ounce of gelatine, which, when kept free from such germs, will remain solid and fresh for an indefinite period.

Pieces of raw hide were inoculated or infected with germs from the above-mentioned cultures and demonstrated very clearly their destructive powers were quite as effective upon it as upon the prepared gelatine.

LIMING.

Soaking completed, the hides were divided into their respective series, ready for liming. This was done in order to determine the effect of limes of various strength; accordingly three limes were made up in a manner supposed to represent weak, medium and strong, and the hides entered as follows:

	Water, gals.	Lime, lbs.
Series No. 1 to lime No. 1, made up of	350	51
Series No. 2 to lime No. 2, made up of	350	71
Series No. 3 to lime No. 3, made up of	350	134

Lime No. 3, it will be noticed, was exceedingly strong, and was intended to demonstrate to just what extent a great excess would affect the hide.

Pure fresh lime was used throughout, carefully slacked and reduced to a liquid before running into the vat. All three series were limed for a similar period—viz., five days (120 hours)—the hides being drawn every twenty-four hours and allowed to drain into their respective vats. A fresh quantity of lime was added each day, so that when liming was completed the quantity equaled 50 per cent. of the original amount used. Thus, in

	Pounds.
Lime No. 1 the total was	76.5
Lime No. 2 the total was	105.5
Lime No. 3 the total was	201.0

Upon completion of liming the hides were drawn and drained thoroughly, the drainage being conducted back to the vats, as in soaking, for measurement and estimation of the hide substance combined and otherwise the lime contained.

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This examination demonstrated the losses due to this process to be as follows:

	Wgt., dry hides. Pounds.	Loss in weight. Pounds.	Loss. Per cent.
Lime No. 1, series No. 1	131.2	5.79	4.4
Lime No. 2, series No. 2	134.3	5.16	3.84
Lime No. 3, series No. 3	126.08	16.78	13.31

From the above we see the minimum loss was in the lime of medium strength, the next highest in the weakest, and excessive in the abnormally strong lime.

The difference between series 1 and 2 is so small that were it not for the depilating effect upon the hides the quantity of lime used in either series would be perfectly safe, so far as destruction of tissue is concerned. However, when the hides came to be unhaired it was found that those of series 1 had not been sufficiently limed. The long hair did not come off freely and the fine could not be worked out without injury to the grain.

The effect upon series 2 was considered very satisfactory, the hair, both coarse and fine, coming freely and leaving the hide in much better condition after working out.

As previously stated, series 3 was subjected to abnormal treatment, and the result in loss of hide or substance which would have made leather is sufficiently striking to require no comment.

During the liming process the bacteriological examinations were continued, putrefactive germs being found in great numbers in series 1, while in 2 the number was somewhat diminished, especially after the third day. In series 3 they were at no time so plentiful as in the others, the strong lime evidently acting as a germicide.

From the limes the hides were thrown all together into a vat of water brought to a temperature of 85 degrees and allowed to remain over night. The loss here was found to be 1.44 pounds, or 0.37 per cent., hide substance (hair, soluble matter, etc.).

UNHAIRING.

The following morning they were unhaired by hand, the hair being carefully recovered. After washing and drying it was found to weigh 28.04 pounds, or 7.16 per cent. There was at this point some loss which could not be accounted for, owing to the washing of the hair and the working of the hide. This, however, is so small that it does not affect the general results to any appreciable extent.

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Leaving the unhairing beam, the hides were rinsed off in a vat of clean water and fleshed by hand with the German spring flesher. The fleshing was done with ordinary care in order that representative results might be obtained. As in unhairing, the fleshings were recovered and all the free lime possible removed, the dry fleshings weighing 15.7 pounds, or 4.01 per cent. The hides being intended for the manufacture of rough leather, bating was omitted. They were, however, left over night in a vat of water at a temperature of 60 degrees.

After being stoned and worked out next day they were left for a further five hours in a vat of running water, when they were drawn upon the inspecting table and allowed to drain preparatory to going to the liquors. After draining forty-five minutes the hides were weighed and samples taken similar to those obtained in the hidehouse before operations were commenced. Thus the water and lime held in the hide ready to tan was determined, and with those figures the quantity of dry hide we had to make leather of was easily got at.

The details of the above are as follows: The net weight of the nine hides ready to tan was 654.84 pounds; this is 7 per cent. more than the original green salted weights; they held 73.84 per cent. water and 1.80 per cent. lime, which being deducted leaves 164.27 pounds, or 24.36 per cent. of the weight of hide purchased to tan.

SUMMARY OF LOSSES.

To sum up, then, the losses as found by the foregoing procedure, we find them as below:

	Per cent.	Pounds.
Total green salted hide used for experiment		612.00
Water in G. S. hide	36.	220.32
Total dry G. S. hide		391.68
Loss in soaking	39.71	155.54
Loss in liming series No. 1	4.4	5.79
Loss in liming series No. 2	3.84	5.16
Loss in liming series No. 3	13.31	16.78
Loss in water before unhairing	0.37	1.44
Loss in unhairing	7.16	28.04
Loss in fleshing	4.01	15.70
Total		228.45
Total hide ready to tan as shown by experiment		163.23
Total hide ready to tan by actual weight before going to liquors		164.27
Difference unaccounted for, 0.26 per cent. of dry hide		1.04

The following scale diagram will illustrate in a graphic manner the true value of the weights and percentages in the foregoing:

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	Per cent. water.
Total dry G. S .hide	36.
After soaking	39.71
After liming	43.55
After unhairing	51.08
After fleshing	55.09

THOUGHTS ON LIMING.

The best tanners agree that no process of preparing calfskins and hides for tanning is better than the lime and arsenic method so long as it is used right. Sulphide of sodium is very rapid in its action, and for some purposes the results of its use are satisfactory, but when an extra fine grain and an elastic leather are wanted, as is now the case in all lines of fine leather, the red arsenic and lime process is proving to be the most desirable. The main thing to guard against is liming the skins too long, as this leaves them soft and flabby. From five to seven days is generally long enough although much depends upon the season of the year and the condition of the skins. Goatskins for glazed kid are nearly all prepared for tanning in arsenic limes, and no leather has finer grain nor more suppleness than this leather. The arsenic limes may be used over and over.

Calfskins and sides are tied together with hooks upon coming from the soaks; and before going into the limes they should be well drained in order to get rid of dirty and salty water. A good lime can be prepared by using two-thirds old liquor and one-third new—that is, of six feet of liming liquor in the vat four feet may be old and weak liquor and two feet new and fresh.

In preparing the new lime about 100 pounds of lime are slacked with about twelve pails of hot water. To this amount about 5 pounds of the arsenic are used. It may be dissolved separately and then mixed with the slacked lime. Both materials need to be thoroughly dissolved before coming into contact with the skins.

The quantities of arsenic and lime mentioned are enough for 500 medium-size calfskins to begin with. After they have been in the liquor one day they should be drawn out and the lime well stirred up from the bottom of the vat. If the skins are allowed to drain before they are put back they will take up the lime more readily. When paddle vats are used the hauling out is not necessary, although it is a good plan to stir the lime up from the bottom occasionally.

On the third day it is well to strengthen the lime by adding to it

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about two pails of lime. The strength, to begin with, should be about 3 degrees Twaddle, and by the adding of more lime and arsenic toward the end of the process it will be about 6 degrees. These are safe strengths to work by, although not arbitrary.

When too much fresh lime is used toward the end of the process the grain may become rough. This may be overcome by a slight washing in a manure bath, followed by a bath of lactic acid. After the hair is loosened it is wise to leave the skins in the lime for a day or two longer, as this not only allows the hair to come off more readily and cleaner but makes the leather softer. When sulphide of sodium is used with lime it is used in much the same manner as red arsenic. These chemicals not only shorten the time of liming but they alco keep the grain from becoming rough, and by making the lime more soluble make it easier for the tanner to remove the lime without injury to the skins.

When plumpness and weights are wanted rather than softness and measurement lime is used alone. No dirt should be allowed to accumulate in the limes, as the cleaner the limes are the brighter and cleaner will be the grain of the finished leather.

A method of unhairing heavy hides which gives good weight, strength and solidity to the leather, although it is not in general use, has been known to produce good results, is to paint the hides either on the grain or flesh side with a mixture of lime and sulphide of sodium. After painting the hides are folded and placed in piles. At the end of twelve or fifteen hours the hair will come off readily and the hides may then be washed in water and the hair removed and then given a further liming for a few days. This shortens the time greatly.

For unhairing horsehides no method is better than sulphide of sodium, as by its use the shell is softened. The hides are either painted or limed in sulphide limes. For glove leather they are limed for ten or twelve days, according to the strength of the limes. Bating with manures, which is so liable to take out too much of the life of the leather and which no workman can control, is being superseded by other methods that remove the lime and cleanse the skins without affecting their texture. They leave the skins somewhat plump and with all their substance intact, and this results in stronger, fuller, more uniform leather. The new methods are much cleaner than the old ones, and much safer. The tanner, however, must decide by the kind of leather he is making and the nature of his tannage which method

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of delivering the skins is the best for his purpose. Some tannages have greater fulling qualities than others, and for such the skins can be thoroughly reduced, and the lost weight made up or regained in the tanning liquors, resulting in a well-filled yet soft and pliable leather.

That tanner is wise who lays aside his preconceived notions and makes a careful study of his processes, since so much of his success depends upon the quality of his leather, and this in turn is determined by the way the hides or skins are prepared for tanning.

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Bark, Extracts, Leaching, Etc.

PREPARATION AND LEACHING OF BARK.

The first and most important item to consider regarding the economical extraction of tannin from bark is its reduction or preparation before going to the leaches.

Unless this part of the work is most carefully performed good extraction is practically impossible, no matter how it is carried out. Hence it is from the lack of due attention to this part of process that many tanners are surprised to learn their spent bark upon analysis contains so much tannin after having used an inordinate amount of water and heat, in the attempt to attain perfect extraction.

When the chemist receives a sample of spent bark for analysis he reduces it by regrinding to a coarse meal, and is thus enabled to get the very last traces of all soluble matter from it. In fact, he gets tanning substances out of it long after a stage has been reached which at the present time could not be profitably carried out on a practical scale.

Bark leached until it contains no more than 1 per cent. tannin in the air dry bark, and calculated back to its fresh equivalent, may be said to be well leached, as the cost involved in carrying the extraction beyond this point will in nearly every instance more than balance the gain. However there are few establishments in which the average leaching will run so low, 3 per cent. being much commoner than 1 per cent. Notwithstanding the many improvements made in recent years in machinery for the preparation of bark, and in the methods of leaching it, there still remains much room not only for the introduction of new methods, but also for the intelligent application of those now in use.

The preparation of bark must be conducted in the manner best adapted for the saturation and percolation of the water or liquor through it. By through the bark we mean not around it, and through

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the interstices of the mass of ground bark, but actually through the pores and intercellular spaces of the bark itself.

BARK MILLS.

As we all know, there are many styles of machines in use, ranging from the old-fashioned exaggerated coffee mill to the recent disintegrator.

Mills of the coffee grinder type are defective, principally on account of the irregular grinding they do. When the mill is set open the bark is too coarse to admit of saturation, or when set close, so fine as to prevent circulation in the leach, and frequently a mixture of both at the same time is the result.

Cutters vary from fair to poor, the defects in their case being their failure to cut the bark in the most desirable way. If they do not dust they sliver the bark up longitudinally or smash it off instead of cutting it cleanly. In most cases the arrangement of the knives does not permit of their clearing the chipped bark freely after making the cut, therefore each succeeding chip has to force the previous one out of the way, and in doing so reduces a considerable portion of the ross to dust. A mixture of shavings and dust does not leach well.

Disintegrating machines under favorable circumstances do fair work, but the tendency is again toward too much dust, and it is hard to secure free circulation in a column of bark prepared in this way greater than six or seven feet in depth.

The ideal preparation of bark is to cut it straight across the end in slices of not over one-eighth of an inch in thickness; such slices or chips will, with the rolling or mixing given them by the conveyor or blower, which takes them to the leaches, be reduced to cubes of about one-eighth inch, and on account of the way they are cut prove peculiarly susceptible to saturation.

Bark reduced to pieces equally as thin as the above, but anywhere from one-fourth to one inch long, will not leach as readily, because the porous surfaces are confined to the ends rather than to the flat surfaces of the pieces. It is the exposure of as much porous surface as possible that simplifies leaching, hence the desirability of cutting in end sections.

While criticizing the work of bark mills in general, it is no more than fair to the makers of such machines to state that many different degrees of preparation may be obtained with the same machine, this

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depending to a great extent upon the care taken in keeping the mill in good working order.

Dull runners or knives should never be permitted. In most machines the reducing parts are usually arranged so that these may be changed with but very little trouble, and in such a short time that it is advisable to do so frequently.

A set of knives fed to their capacity ought never to be run over five consecutive hours, and if they can be changed every three hours the results will pay for the time lost making the change.

The feature most to be desired in a cutting machine is a sharp, and not a rasping or tearing cut. Constant attention should be given this point, and as soon as the cut bark shows indications of being broken or smashed instead of cut change the knives, whether they have run their full time or not.

In some establishments it is the rule to put fresh knives on at stated intervals, little regard being paid to the condition from one hour to the next during the run. That this is a mistake there is no doubt, for it is a matter of common occurrence to get some foreign body introduced with the bark, which puts them in worse condition in five minutes than five hours of actual cutting. A piece of iron or slag can rarely enter the machine without attracting the attention of the men feeding it. As a rule, it is immediately removed in order that work may proceed without damage, but a careful examination of the reducing parts should be made, and in case of chipped knives or dull runners resulting they should be immediately replaced with perfect ones. It will pay, for a dull knife or grinder means not only imperfectly prepared bark, but a serious loss of time owing to the reduced capacity of the machine.

LEACHING.

In proceeding with the extraction of the tanning substances from the bark we will only consider what may be termed the "open diffusion" or continuous pumping over system, it having so generally replaced the older methods of pressing forward and pumping up a leach and drawing of the liquor in "runs." It has been found that where liquor is taken off at a constant average of 16 or 18 degrees barkometer, a column of not less than 140 feet is necessary to leach to the best advantage well prepared bark. That is to say, assuming we have a column of bark contained in a suitable number of leaches equaling

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a total of 140 feet, the first ten feet will be leached when we have pumped all the liquor obtainable off the last ten feet, which averages 16 to 18 degrees barkometer, commencing on the first leach with water at a temperature of 130 degrees Fahrenheit and gradually increasing this temperature so that when liquor is being pumped on the last ten feet of fresh bark it will have reached the boiling point on the first ten feet. It is to be understood that as much liquor is being pumped off every ten-foot section as can be made to average the degree barkometer previously referred to.

Good dry hemlock bark will yield in round figures 1,000 gallons (oak about 1,100 to 1,200) of 16 to 18 degree liquor per cord of 2,400 pounds. It therefore requires, approximately, 5.75 gallons of water to leach reasonably well one pound of fairly prepared bark, the temperature ranging from 130 degrees at the beginning of the process to 212 degrees near the end.

Where liquors are required heavier than the above, the bark column should be lengthened, and in cases where the course above outlined can not be carried out, some modification may be introduced which will enable the tanner to secure the desired economy, only he must be extremely careful as to the modification.

Next to the preparation of the bark, the question of temperature is the most important in obtaining a good extraction, and must receive the closest attention in order to perform good work. With a system of leaches aggregating the desired length of column, divided in ten-foot sections or consisting of fourteen leaches, the temperature, as we have previously stated, should run from the boiling point on the tail leach to 130 degrees Fahrenheit, *going on the head,* the temperature of the intermediate leaches being divided in proportion to their number.

Heat is absolutely necessary to remove the last portions of the available tannin, not that it is difficult to dissolve, but in order that the bark may be swollen and thus disintegrated to an extent sufficient to admit of the removal of the soluble matter. It is, however, undesirable to apply this heat on the head or fresher leaches, as it would remove a quantity of matter that is insoluble in a cold liquor, and therefore objectionable in the yard.

By applying the heat to the tail and weaker leaches, the desired effect of removing the tannin is secured, while the liquor cooling, as it is pumped forward, precipitates much of the objectionable matter which is filtered out as it passes through the cooler leaches to the head, thus

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yielding clean liquors containing little soluble matter, and which will show up on analysis the proper percentage of tannin for their gravity.

In operating such a system of leaches, it is also important that the leaches be kept flooded continually; that is, covered as nearly as possible with water or liquor in order that the bark may be kept in partial suspension, and the circulation thus maintained even throughout the entire mass.

As soon as the liquor is pumped below the surface of the bark packing ensues, and the water or liquor being run on takes the most direct route to the suction pipe of the pump, therefore the bark lying above the level of the liquor in the leach does not receive its due proportion of water and as a consequence is imperfectly leached.

A good idea in this connection is to have an eye-box with a wooden measuring rod in it, in each leach, by means of which the depth of liquor can any time be readily ascertained.

When the circulation is good the liquor in the eye will be found about one foot lower than the level of the bark.

It has been shown that by leaching on the lines herein set forth every unit of available tanning substance can be accounted for which the fresh bark originally contained, that not found in the liquor being found in the spent bark.

There is one practice—fast dying out, however—which presents a serious obstacle to good extraction; we refer to the return of spent hanger or handler liquors to the leach house. Where this is done, the spent bark may show upon analysis thorough extraction, but an examination of the liquors usually proves them to fall short of the normal contents of a good liquor. This old liquor being run on the leaches at a comparatively high temperature, and containing considerable quantities of acid, is responsible for the destruction of much tannin.

To change this way of working may in many yards seem impracticable, but there is always a way around it. It is impossible, however, to prescribe a remedy that will suit every case, and a study should be made of each individual one, with the conditions governing it, before suggestions in the way of improvements are made.

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COMPARATIVE TABLE OF TANNIN CONTENTS OF FRESH OAK, HEMLOCK AND QUEBRACHO LIQUORS FROM 1 TO 30 DEGREES BARKO AT 60 DEGREES FAHRENHEIT.

Deg. Barks.	Oak.	Hemlock.	Quebracho.
1	0.1323	0.1677	0.217
2	0.2646	0.3354	0.434
3	0.397	0.503	0.651
4	0.5184	0.6368	0.912
5	0.648	0.796	1.14
6	0.7776	1.0458	1.3374
7	0.9072	1.221	1.57
8	1.037	1.3184	1.8048
9	1.1763	1.4932	2.0104
10	1.306	1.6480	2.256
11	1.4421	1.813	2.4464
12	1.577	1.915	2.6688
13	1.7251	2.1658	2.891
14	1.8578	2.3324	3.0898
15	1.990	2.599	3.310
16	2.1905	2.723	3.4448
17	2.3273	2.8934	3.66
18	2.465	3.064	3.7972
19	2.599	3.2813	3.9036
20	2.736	3.454	4.108
21	2.8728	3.612	4.027
22	3.010	3.784	4.221
23	3.153	3.956	4.462
24	3.290	4.128	4.656
25	3.427	4.300	4.850
26	3.564	4.472	5.044
27	3.701	4.644	5.238
28	3.838	4.816	5.432
29	3.976	4.988	5.626
30	4.113	5.160	5.820

NOTE.—The oak and hemlock figures are based upon liquors made with water from prime bark. The quebracho upon dry extract of good average quality of domestic manufacture.

QUESTIONS AND ANSWERS ABOUT VATS, LEACHES AND LIQUOR LOGS.

VATS.

Question. Thickness, ends? Answer. Two inches.

Q. Thickness, sides? A. Two inches.

Q. Thickness, bottoms? A. Two and one-half inches.

Q. Material used in construction of? A. Hemlock.

Q. Is material absolutely clear? A. No. Sound, with no black knots.

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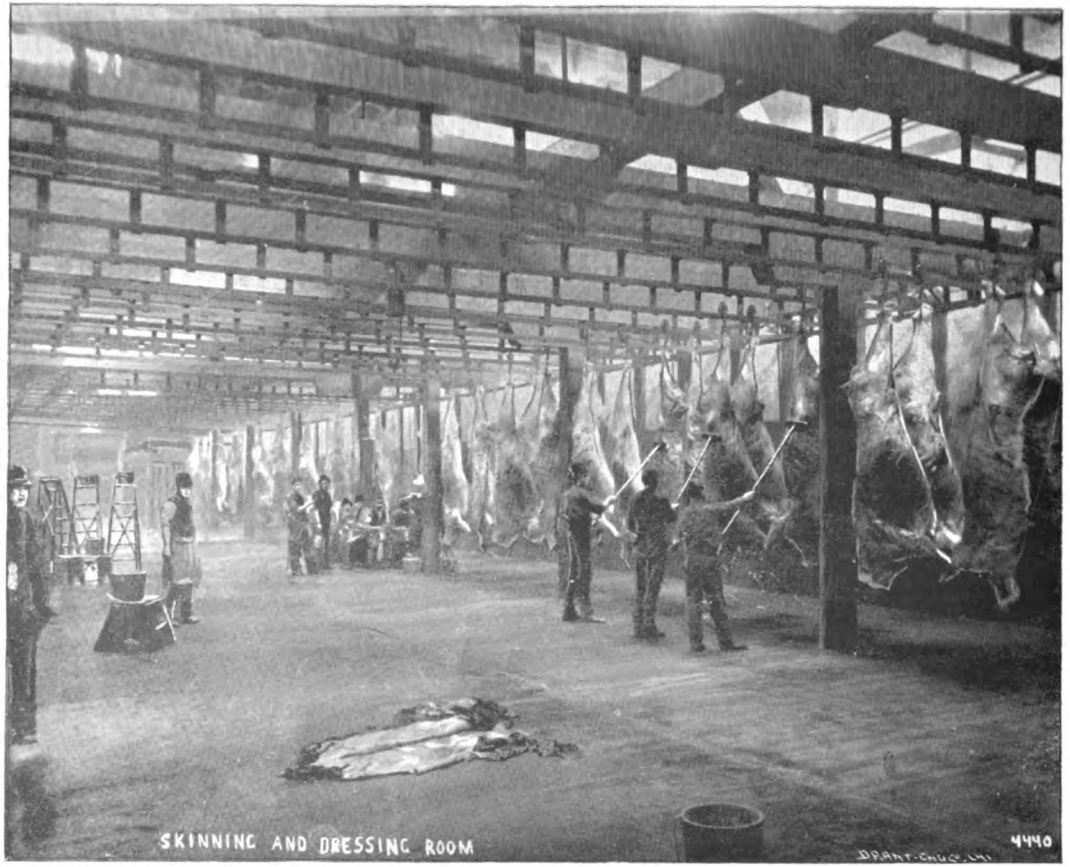

AT THE STOCK YARDS.

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Q. Price of material per thousand, delivered? A. Fourteen dollars ($14).

Q. Will material shrink? A. Yes.

Q. Swell? A. Yes.

Q. Warp? A. If not kept wet.

Q. Narrowest planks used? A. Six inches.

Q. Widest planks used? A. Any width over six inches.

Q. How long will vats last? A. If kept full, thirty to forty years.

Q. Cause of final decay? A. Rot, beginning at top of stave.

Q. How long can remain empty without damage? A. Twenty-four hours.

Q. Cost of work on vat? A. Ten by 10 by 5¼, eight dollars ($8).

Q. Cost of setting up vat? A. Ten by 10 by 5¼, seven dollars ($7).

Q. Do tanners put in new vats and leaches during winter months? A. Yes, under cover.

Q. What filling is generally used between vats, when set up? A. None.

LEACHES.

Q. Are they round or square? A. Round in most tanneries.

Q. If round, thickness of staves? A. Two and a half.

Q. Width of staves? A. Six to eight inches.

Q. Thickness of bottom? A. Two and a half inches.

Q. Material used? A. White pine or cypress.

Q. Is material absolutely clear? A. No. Free from black knots, sap, shake or checks.

Q. How long can they remain empty without danger? A. Twenty-four hours.

Q. How long will they last? A. Six to ten years.

Q. Cause of final decay? A. Rot from outside.

Q. Price of 20,000 gallon tank K. without hoops? A. One hundred and twenty-five dollars ($125).

STORAGE TANKS.

Q. Are they round or square? A. Generally square.

Q. What material are they made from? A. Hemlock or pine.

Q. Average size? A. Ten by ten, or five or six feet deep.

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Q. Average thickness of material? A. Two inches.

Q. Price of material? A. Fourteen dollars and $25.

Q. If square, narrowest planks used? A. Six inches.

Q. Widest planks used? A. Any over six inches.

Q. How long can they remain empty without damage? A. Twenty-four hours.

BORED LIQUOR LOGS.

Q. Material made from? A. White pine, cucumber or cypress.

Q. Price of pipe? A. Twenty dollars to $30 per 1,000 and about 5 cents per lineal foot for boring.

Q. Lengths of pipe? A. Twelve to sixteen feet.

Q. Lasting qualities of pipe? A. If submerged, indefinite. Exposed to air, six to twelve years.

We should state that the cost of vats, etc., depends upon where made and the vats put up in squares or yards of forty vats or more exclusive of the excavating and the leaches in a number of ten or more, exclusive of foundation and supporting timbers, estimated on a leach, twelve-foot stave and sixteen-foot bottom, the capacity of which would be a little less than 20,000 gallons.

The longevity of vats is indefinite, but much is added to their life if the entire outside of yard is thoroughly tamped full of moistened clay and the vats kept full of liquid up to the top of the staves and not allowed to stand empty.

The life of the leaches is owing very much to the manner or process of leaching the bark. If they are used for steaming or cooking the bark therein it destroys them much more rapidly than by running the hot fluid onto the bark.

The white pine liquor logs are considered preferable to the others and should be made from forest growth timber with the heart in the center of each square.

DETERIORATION OF YARD LIQUORS.

RUNNING DOWN.

One of the most persistent and frequently met with tannery troubles is a periodical "running down" of the yard. By "running down" we mean that the liquors fail to produce the results expected of them in tanning, while to all external appearances they are "just the same as they always were."

No doubt there is more than one cause for this condition occur-

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ring, but the blame is most frequently laid to every cause but the true one. In the majority of instances the trouble is due to nothing more nor less than deterioration of the liquors themselves, a condition that cannot be determined without the aid of analysis, excepting of course the observation of the failure of the liquors to do the work expected of them.

In most yards the barkometer is still the standard of testing the strength of a liquor, and it would require considerable ingenuity to devise a more deceptive method of determining its tanning value, for the gravity of liquors, unless made directly from water, means absolutely nothing. Therefore the innocent, though misleading barkometer, is not infrequently the most costly appliance about a tannery. The commonest cause of deterioration of liquors is their return to the leach house, after they have been spent in the yard, and the following will serve to illustrate how such a condition may come about. A normal hemlock liquor made from water contains say 5 per cent. of soluble matter, of which some 68 per cent. is tannin and 32 per cent. non-tannin. From the moment this liquor is applied to the raw hide this ratio immediately commences to reverse itself, the proportion of non-tanning substances gradually increasing from vat to vat until the last or tail one is reached; here it will be found that the ratio is something like 27 per cent. tanning and 73 per cent. non-tannin, being a serious exchange of proportions between tannin in the head or fresh liquor, and non-tannin in the spent.

BARKOMETER NOT INFALLIBLE.

This then is the point where the barkometer fails to show the value of a liquor.

For instance a liquor of 15 degrees barkometer, which should contain some 3.25 per cent. soluble matter, 68 per cent. of which is tannin and 32 per cent. is non-tannin, will, when it reaches the tail row of a series of say eight rows of vats, weigh approximately 9 degrees barkometer, but instead of containing 1.31 per cent. of tannin and 0.52 per cent. non-tannin, which a fresh 9 degree liquor should contain, it will only contain 0.69 per cent. tannin, the balance, 1.25 per cent., being non-tannin.

As previously stated, it is the return to the leach house of this liquor so rich in non-tannin, largely charged with acids, acid forming ferments and bacteria not only possessed of the property of decompos-

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ing liquor, but also hide, that causes much of the trouble with yard liquors.

The liquor is drawn off, pumped to the leach house, run through a heater and sent over the leaches, and when the head leach is reached it is run off through the coolers to the yard as long as the desired barkometer degree is maintained; but the liquor lacks a great deal of being what it was when the leach house and yard were started up on liquor made from water. The ratio of non-tannin has increased wonderfully, and each day it keeps on increasing until eventually the tanner wakes up to the fact that his leather is not coming along as it ought to, and how can it when from day to day, month in and month out, he has been robbing the liquor of the requisite tannin and replacing it by the filth which naturally accumulates in a yard?

EXAMPLE OF DETERIORATION.

As an example of how this deterioration comes about, let us cite a case, one of several which have come under our observation. A light leather yard was started on fresh liquors, nothing but water being used in making them up. The liquors used in the head row of vats stood at the desired barkometer degree of 16 and contained 3.46 per cent. soluble matter, 2.31 tannin and 1.15 per cent. non-tannin. When the yard was full and in complete running order the tail liquor, which in this particular instance was reduced to 7 degrees barkometer, with 1.44 per cent. soluble matter and 0.3 per cent. tannin, was returned to the leach house, raised to 16 degrees and sent back to the yard for further use.

Now, for thirty days or so after the yard was full it was watched very closely by all concerned and the results were pronounced satisfactory. After this attention was somewhat relaxed and it was not until the yard had been running five months that the foreman decided that his leather was coming too green—a question he had been debating in his mind for some time—and he immediately proceeded to brace it up by grinding a few more cords of bark daily.

The bracing was continued until the quantity of bark was increased 20 per cent., thereby adding a like percentage to the cost of tanning material. Still satisfactory results were not obtained, and it was about decided to close down the yard and start afresh. Before doing so, however, it occurred to the tanner to investigate the condition of the

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liquors. This was done with the following results: The 16 degree liquor coming from the leach house was found to contain instead of 2.30 per cent. tannin, 1.25 per cent. or little over one-half the percentage a normal liquor should contain.

It was therefore not hard to account for the falling off in the tannage. To have secured a liquor equivalent to that used the first thirty days it would have been necessary to have raised the barkometer degree to nearly thirty. Under such conditions uniformity in tanning would practically be an impossibility.

The instance above given is no doubt an extreme one, but nevertheless the same thing is going on to a greater or less extent in many tanneries.

The remedy for this particular evil is so obvious that were it not necessary to demonstrate the economy of it—for the writer's experience upon telling tanners to run their tail liquors in the sewer has been that they were shocked at the apparent reckless watse of good liquor—we might leave it to speak for itself.

By all means run the sour, filthy spent liquor into the sewer; it is no better than sewage, and a clean, sweet leach house is the last place a tanner would wish to defile.

But before doing so be sure the liquor is spent. After the tannin contents of a liquor are reduced from 3 per cent. to 0.25 per cent. of tannin, they may be discharged as unfit for further use without any danger of incurring a greater cost for tanning. The water that replaces them in the leach house will extract more than enough additional from the bark to make up the apparent loss.

It may require a few changes in the method of manipulation to reduce the tannin contents to 25 per cent., but it can be done without any risk of injury to the hides. And when this point is reached the tanner will find that not only has he improved his leaching, but that he has attained a very high standard of economy, together with a method that will tend greatly to yield uniform results the year round and from one year to another.

As a matter of fact, the only way to produce uniformity continuously in the yard is to make frequent determination of the tanning value of the liquors, and maintain them to the standard he finds best suited to the class of stock he manufactures.

It may mean the services of a chemist and consequently some expense; but now that the chemistry of the tannery has advanced to the

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point of practical application the cost will with intelligent administration be many times repaid.

USE OF HEMLOCK EXTRACT.

The best and most successful methods of using extract have to be learned by experience, which is often expensive, and is therefore kept secret. Some tanners think that all they need do is to dump the extract into the sweet liquors and the strength will be accordingly raised. This is wrong. The following method is often chosen: Heat a vat of weak, sweet liquor to 120 degrees, and let the extract be constantly stirred as it drips in. The extract will pretty thoroughly dissolve, and the liquor thus made can be used to strengthen the ordinary layaway liquors from the leach. In course of time the layaways will turn sour and after doing duty in the handlers will be passed through the heater box and filtered through old leaches. This will be found to work satisfactorily. Several tanners claim to use extract exclusively and do without bark. The objection to this scheme lies in the hard nature of extract. It does not sour as readily as leach liquors. Tanners, ignorant of this, have been disappointed at results. Hemlock and oak extract are very valuable materials, and are growing in use and popularity. They should be studied carefully and then their good points will become apparent.

PROPER USE OF EXTRACT IN YARD LIQUORS.

With the constantly and rapidly increasing distance between the tannery and the source of tanning material, the demand for extract has steadily increased during the past few years. That the demand is still growing is very evident, for, witness the number of new extract manufactories being erected, and the constant increase in capacity of most of those already in operation. This condition, coupled with the fact that immense quantities of foreign tanning material in form of extracts are being imported, would indicate that it is only a matter of time, and perhaps not such a very long one at that, until the tanner will find it more economical to use extracts for producing his leather than maintaining extensive grinding and leaching plants, besides existing in a condition of "eternal vigilance," in order to secure his tanning material at a price which will even now compete with that of extract. Doubtless there will always be tanneries so fortunately located that

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extract will never come into competition on a question of cost of tannin, but the great preponderance of capital invested in the production of leather in this country, has been put into large plants which are even now remote from the bark regions, and it is in such tanneries that extract is most freely used. There are only a few, however, who are willing to admit that extract can be used as economically as bark, but "that is another story," and it is in view of this ever increasing and apparently compulsory consumption of extract the question, "Does the tanner use extract in the manner calculated to obtain the full benefit of its tannin contents?" occurs to us as important.

USE AND ABUSE OF EXTRACT.

It has been the writer's privilege to witness the manner in which extract is used in a great many tanneries, and he is obliged to confess that in the great majority of instances the use might more aptly be termed abuse.

There are tanners who will stoutly hold out—and usually successfully, too—for an extract that contains a guaranteed percentage of "tannin," and if it falls 1 per cent short proceed to deduct the ratio of shortage from the cost, which is all good and proper, but after accepting the goods they allow them to go to the yard, to be used in such a fashion that a loss of 2 or 3 per cent is incurred, but which because it is not evident at the time is entirely lost sight of. Again, there are others, who will as stoutly maintain that if an extract is shown to contain 25 or 30 per cent. of "tannin," it is impossible to practically demonstrate it in the production of leather; never pausing to consider they might just possibly have overlooked some little but important detail in making the demonstration. It is much easier to "kick" at the man who makes the goods and who most frequently is not a tanner, and therefore cannot help his customer nor himself with a little advice as to the best way of using extract. Here the extract manufacturer is at fault, for if he does not make it his business to educate his trade it is unlikely they are going to waste much time or money on experiments. Now, why extract should not yield liquors as rich in tannin and also yield every unit of tannin they contain in a form suitable for combining with hide is a question which usually can be answered by investigating the method of converting it into liquor, and we are willing to go on record by asserting that, excepting the unavoidable decomposition of tannin which occurs in every yard, all

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the tannin an extract contains, as shown by the analysis of a reliable chemist, can be converted into leather, and further a good proportion of the reds, so-called, can be made use of. Before proceeding to offer any suggestions as to the best methods of preparing liquors from extract, let us take up one or two of the less commendable ones, and examine into the objectionable features they possess.

The worst, probably, is one that is very common, and is used, we think, most frequently by tanners of light leathers, who tan altogether in hangers. This method consists in rolling in a few barrels of extract to the head row of vats, knocking in the heads and dipping out the extract with a bucket—regardless of temperature of either liquor or extract—and emptying it into the vat while a man plunges it up, in the same fashion one would plunge a lime, the said plunging rarely lasting more than five minutes after the last bucketful is emptied in. A questionable improvement on this is to pump the extract into a tank containing the liquor to be strengthened, and stirring it with an agitator driven by power; some heat the extract in a tank fitted with a steam coil before pumping it into the liquor, but the improvement in this case is chiefly confined to rendering the extract more fluid and thus easier to pump. Aside from the two methods given, there are a great many modifications, but unfortunately they are productive of practically similar results, and about the most that can be said for them is they are convenient. Of the objections to such methods of procedure, a little consideration will show it is almost an impossibility to produce a uniform liquor by plunging a vat for a matter of fifteen minutes by hand: it is bound to be streaky, and indeed has conclusively been shown to be so. Therefore, the primary result is portions of the hide get an undue share of liquor, while others do not get enough, this fact often accounting for some hides being more thoroughly tanned than others. Where mechanical agitation or stirring is practiced, this fault is largely obviated, but the excess precipitation caused by the cold dilution of an extract is about equal in either case. It is a well known fact that the solubility of an extract depends entirely upon the liquor or water with which it is diluted. For instance, a liquor which is perfectly soluble and clear at a temperature of 75 degrees Fah., will become opaque and throw down a precipitate when cooled to 50 degrees Fah. Refilter this, and reduce the temperature still further and a similar result will follow.

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CAUSE OF LOSS.

This excessive precipitation is the chief cause of loss when extract is diluted with cold liquor or water. It makes but little difference whether the bucket and plunger, or the stirrer method is made use of in making up liquors, a great quantity of material which would otherwise go toward the making of leather is rendered insoluble, and what does not settle upon the hides, and thereby retard to a considerable extent the tannin, falls to the bottom of the vat to be thrown away when the vat is cleaned.

Of course all of this precipitate is not thrown away or lost. If it was, the loss would be so great in many instances as to make the use of extract prohibitive. The reason it is not, however, is due rather to natural causes than foresight or premeditated action on the part of the user.

Every time the hides in process of tanning are handled over or drawn, the liquor is stirred up to a considerable extent, and being weaker by just the quantity of tannin taken up by the hide, is capable of dissolving quite an appreciable portion of the precipitate thus disturbed.

This gradual solution is continued from stage to stage of the process, and by the time the liquor reaches the tail vats, or is returned to the leach house, comparatively little beyond what has settled on the bottom of the vats and has not been stirred up during the handling of the leather is lost. Unfortunately the bottom of the vat is the ultimate resting place for the major portion of the "sediment" during the entire tanning process.

From the foregoing it is obvious that the principal defect in the preparation of liquors from extract, is that of a low temperature in diluting it.

ECONOMY IN USE OF EXTRACT.

Extract, to get the best results, should never be mixed with water or liquor at a temperature lower than 150 deg. Fah., and 170 is preferable.

When old liquors containing any considerable quantity of acid are used as a base, it is not good practice to add the extract until the liquor has been run through an open heater at the boiling point, the heater being provided with a good drawing chimney to carry off the volatile acid liberated by the boiling.

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This treatment will remove most of the acid and thereby materially lessen the quantity of tannin destroyed by it during the mixing of the extract with hot liquor.

The heating of the liquor being absolutely essential to obtain the best results in dissolving extract, the foregoing will be found not only as cheap as any other method of doing it, but of much benefit as an economizer of tannin, and also an aid to the maintenance of sweet liquors in the yard.

In cases where a modern leach house is accessible, a convenient and economical method of mixing extract may be practiced by emptying it upon the head leach and dissolving it by pumping forward the liquor —which should be about the proper temperature at that stage of the process—in the usual way.

By this means the first liquor taken off can be obtained by gravities suitable both for immediate use and for strengthening purposes. For the latter purpose it is not necessary to have the liquor to be strengthened heated to such an extent as when cold extract of full strength is used, inasmuch as a warm solution of extract is obtained by passing it through the leach.

To carry out the suggestions herein given it is necessary to have a sufficient number of tanks for cooling at least one day's run of liquor, although if coolers enough for two days' runs are used it is so much the better, as, besides giving the liquor time to cool, it also admits of the settling of such sediment as is absolutely insoluble and consequently better gotten rid of there than by precipitation in the yard later on.

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Chrome Tannages.

MANUFACTURE OF CHROME CALF.

There are four grades of green calfskins, Nos. 1, 2, 3, and culls, The No. 1s are selected for scores on the flesh side; No. 2s are scored and cut; No. 3s badly cut; culls are very badly damaged and hair slipped. Dry calf are selected the same way.

Green salted calfskins are soaked in a tub of water over night; the next morning they are taken out of water, worked with a flesher on the flesh to take off the fat and the meat, and then trimmed. That is the head, shanks and tail cut off. Then they are put in a lime vat with flesh side down. Next day they are hauled out of lime and put in again with hair side down. The reason they are put in lime the first time with flesh down is to prevent the lime affecting the grain. They are left in the vats for five days, hauled again, and some new lime slacked, which is mixed with old lime. Put skins back again, leave them there for five more days. This makes ten days in lime, which is enough in summer. In winter time give them four days longer lime.

Take skins out of lime, unhair with hairing knife, put in tub of water, wash well to get all the lime out of them, then flesh. After fleshing, put them in pure. Pigeon manure is the best for calf. Soak the manure in a little tub the night before using, so that it is well dissolved; then strain it into a large vat with water about 90 degrees. Let skins soak in this manure water until they get nice and soft, then slate them. After they are slated, put them in a wash drum or reel with water at about 70 degrees, make a bran drench, take skins out of wash drum or reel and put in the bran drench, at 90 degrees, over night. If skins are put in bran drench at 6 p. m. at 12 o'clock they will be on top of the vat. Push them down again; then in the morning repeat the operation. At 12 noon they are ready to take out. Wash them as before; skins will then be good and clean, free from all lime and impurities.

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Bran drench and pigeon manure can be done away with by the use of dog manure, but with it there is a risk and it does not make as nice leather.

Now, the calfskins are ready for any tannage, alum, combination chrome.

For the two-bath chrome leather, the skins are taken out of bran drench, put on a scale, and to every 100 pounds of skins take 6 pounds of bichromate of potash to 2 pounds of muriatic acid; dissolve the 6 pounds of bichromate of potash in 10 gallons of water, let run in drum about two hours, then cut the thickest part of skin and see that the chrome has thoroughly permeated them; take out of drum, strike out on flesh with steel slicker.

For the second bath dissolve 12 pounds of hyposulphite of soda and 2½ pounds of muriatic acid in 60 gallons of water in a reel. Put skins in the reel and run them until they get blue; cut and see that they are blue throughout, then wash them in a wash drum, letting clear water run over them until clean. They are next put out with a slicker, then shaved and afterwards stained with a little logwood liquor, composed of 1 gallon of logwood liquor and 2 buckets of water put in a drum. Then dissolve therein 1 ounce of violet aniline. Let skins run one-half hour, then take them out of drum.

Fat liquor for 100 pounds of skins take 1 pound of neatsfoot oil, 3 pounds of soft soap and 3 gallons of water. Have this liquor about 120 degrees. See that the oil is well cut, so that the skins will take it all up.

Now they are ready to color black. Fold skins at the head and tail; give them a sig with brush on grain side; run them through logwood three times in a tray or box, then pull them through the black. Put out either by hand or machine and give a light coat of glycerine, mixed with water. Lay this way over night, then take slicker and go over the grain very lightly; give skins a good coat of neatsfoot oil, and hang them up in the heating rooms. When dry, put them in a cool place for a few days, then dampen them in water or sawdust. When damp enough, stake them either by hand or machine; again hang them up and perch them. Then trim them with a knife or shears.

Now they are ready to season. Every manufacturer has his own seasoning; all say they have the best. After they are seasoned, they are hung in the heating room about ten minutes, then they are glazed

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and seasoned the second time. Glazed again, you can now either have the smooth grain or "box," as it is called. To box them a rolling machine is used in which they are rolled their length and width. After they are rolled, take a cork board and cork them in the length and width and you will have an article equivalent to the best there is on the market.

HOW OIL IS SULPHATED FOR ACID FAT LIQUORS.

Select a cool place where abundance of cold water is at hand. Two troughs are needed. The first for purposes of chilling; the second for scouring. The first trough should measure eight feet long, two feet deep and two feet wide, and be water-tight. It should have a plug at the bottom so it can be easily emptied. Cold water connection should be made with this trough by means of a hose. The trough should also rest on the floor, in close connection with a waste pipe.

Into this chilling trough place four stone crocks, a few inches apart, each crock holding fifteen gallons. Put six gallons neatsfoot oil into each crock. The trough should now be half filled with water in which the crocks should stand for two hours to chill. And this is helped by stirring the oil from time to time with a paddle, when it will be ready for the acid treatment.

Pour six ounces of sulphuric acid four times a day into each crock at intervals of two hours. This means three pounds of acid for each crock. The mixer should take great care to pour the sulphuric acid or vitriol very slowly into the oil, and should constantly stir the oil, so that it will not be burned. Keep the paddle busy, and the good results obtained by doing this properly will well repay the trouble.

Probably the best method is to let the oil chill over night, then add the acid the first thing in the morning. After a little experience a man will find it easy to pour the six ounces of acid gently on to the oil with one hand, using the paddle with the other hand, and thus assuring success. It is wise to stir the oil for fully five minutes after the acid has been added. After properly treating one crock, keep on until all four crocks have been visited. Then begin on the first crock again and stir for five minutes. Assuming that this treatment was begun at the beginning of the working time in the morning, the second treatment of acid should begin at 10 o'clock, and the oil be kept stirred as during the first treatment or addition of acid. After the four crocks

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have been treated the second time the contents should be stirred for five minutes every half hour.

At 1 o'clock on the same day the third treatment of acid should be given and the fourth dose at 4 o'clock in the afternoon.

At 7 o'clock the next morning apply the fifth; the sixth at 10 o'clock; the seventh at 1 o'clock, and the eighth at 4 o'clock, which completes the work.

It will be noticed that this sulphating is not difficult, but needs much care and attention, and after the first treatment it will not be difficult to continue the work in exactly the same manner at stated intervals of time.

On the following morning the sulphated oil should be quite greyish in color, which is the best indication that it has been properly sulphated and is in fine condition. If black streaks should be apparent, however, through the oil, this shows that it was damaged because of lack of proper treatment, for which there is no excuse. The stock is now ready for scouring, which is done in a trough which should stand sixteen inches from the floor, and measure five feet long, two feet wide and two feet deep. It should have a spigot and a stopcock level on the bottom of it.

Over this trough should be cold water and steam water connection so fixed as to be readily combined, so that lukewarm water can be easily run into the trough, and much of it will be required. The scouring of neatsfoot oil is done with glauber salts, large quantities of which are required to neutralize the qualities of the acid, and remove all traces of it from the sulphated oil.

The sulphated oil is emptied out of the crocks into the scouring trough. To this quantity of oil add fully three times as much lukewarm water. Weigh 96 pounds of glauber salts and see that all lumps are pulverized so they will dissolve readily. The salts are now thrown into the trough, then worked with the paddle lengthwise, and the whole mass of liquid kept in perfect motion. This should be done once every half hour for five or six hours.

By 4 o'clock in the afternoon the oil will have risen to the top of the water, and the latter should then be withdrawn and run off through the stopcock. The oil is now ready for the next wash. This time 72 pounds of glauber salts are added to same amount of water as in the first wash, and proceed similarly now as then.

By 9 o'clock the next morning the stock will be ready for the third

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wash, which should be done as previously, but only 60 pounds of glauber salts are used. For the fourth and last wash, which should be given at 4 o'clock in the afternoon, not more than 48 pounds of glauber salts will be required. Next morning, after the water has been run off, the sulphated oil has become perfectly scoured, ready for use and should be of the color of sulphur. It will mix with water without forming globules, the absence of which indicates that the process has been successful, and you now have twenty-four gallons of sulphated oil which will make five barrels of acid fat liquor, figuring five gallons of sulphated oil to a barrel of water.

FORMULA FOR SULPHATING.

Here is a repetition of the formula for making sulphated oil:

Twenty-four gallons neatsfoot oil, divided between four crocks.

Twelve pounds sulphuric acid, or vitriol, of which eight applications in two days are given to the oil.

Two hundred and seventy-six pounds of glauber salts, divided into four applications, given in two days.

To be more exact, six gallons of neatsfoot oil should be treated with six ounces of sulphuric acid, four times a day for two days. After this treatment the oil should be scoured or washed twice a day for two days with the following weights of glauber salts, 24, 18, 15 and 12 pounds per crock.

This sulphated oil is most valuable material and a few years ago its method of manufacture was regarded as a great secret.

The men who travel from tannery to tannery, to tan and finish upper leather, are usually bright and quick to learn and it seems impossible for any secret in the manufacture of leather to be kept intact for long.

Many leather finishers manage to become well versed in chemistry, and do considerable experimenting both at home and at their work, so eager is their desire and ambition to excel and make a record for themselves. Such men often meet with their reward, are given an interest in business and are thus retained permanently.

This method of recognizing ability usually proves to be a splendid investment for the manufacturer who makes it, as the bright and clever fellows who can make leather a little better, or handsomer, or more attractive than their competitors, enable their employers to reap large profits in which they often participate.

However, to go back to sulphating oil, I wish to say that it is used

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principally in the manufacture of Russia, genuine and imitation kangaroo leather, satin and grain, and also goatskin leather. It takes the place of oil, and yet is far more valuable than ordinary oil and has a splendid softening effect on grain leathers, preventing cracking. It is used on the leather after it has left the tan liquor, and is put into the mill, same as ordinary fat liquor. The temperature in the mill should not be over 90 degrees. I should add, that in sulphating oil, if the water is not cold enough in the first trough to thoroughly chill the oil that ice should be added.

As many leather manufacturers may try to sulphate oil by the method herein described, here is a test by which you may be sure your work has been properly done. Put an ounce of the sulphated oil into a pint of water at 90 degrees. Shake well and let it stand.

If separation of the material is apparent, it is a sign that the oil has not been properly sulphated. If, however, the mixture remains emulsified, you can rest satisfied that your work is well done.

MAKING CHROME CALFSKINS.

No leather introduced by American tanners during the last few years has given more satisfaction so far as looks and wearing qualities are concerned as chrome-tanned calfskins.

Like all leathers produced by the chrome process, this leather is remarkably tough and strong, always remains soft and is water-resisting to quite a degree. Complaints are sometimes heard in regard to this leather being hard on the wearer's feet, but such objections are often more fancied than real.

In producing chrome-tanned calfskins both the two-bath and one-bath processes are used. The former has a tendency to contract the skins, thus causing shrinkage, while the latter process must be carefully applied in order to keep the grain from drawing or puckering under the astringent action of the chrome liquor. In order to get the colors as they should be the grain of the skins must be free from grease and stain, and as clear as possible.

The skins must be carefully worked in the beamhouse; and all the lime must be gotten rid of before they are tanned. At the same time it is necessary to watch the skins during the drenching process, as calfskins are very tender and very easily damaged by being bated or drenched too low.

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A CORNER IN LEATHER

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No matter which process is used, after being tanned the leather must be thoroughly washed, first in warm borax water for twenty minutes and then in clear water for another twenty minutes. This washing is done to rid the stock of all the salts and acids used in tanning, thus putting the leather in proper condition for coloring and finishing.

The skins may be colored in drums, vats or may be brushed on tables. The drum method is usually considered the best, as more even colors result when this method is used.

When a drum is used in coloring, very little water is needed, but the quantity of dyeing material is the same as when other methods are employed.

It is good practice to rid the leather of as much of the surplus water as can be gotten out before coloring it. This is accomplished by pressing or striking out the leather after it has been washed.

When fancy light shades are to be given the leather in a drum, the skins should be colored and then fatliquored; but when the colors are applied with brushes it is better to fatliquor them before coloring.

A mixture of lime and sulphide of sodium may be used for unhairing and the skins left therein for a few days according to their weight and thickness.

Red arsenic is also used in connection with lime, and tends to produce a finer grained skin than sulphide of sodium, with more gloss and elasticity.

Prolonged liming causes the leather to be loose and spongy.

The best leather is made by neutralizing the lime without the removal of any of the skin substance. Low liming produces fine, close-textured leather; but too low liming leaves the skin hardy and liable to crack.

When the two-bath process is used the chrome liquor of the first bath should be allowed to penetrate every fiber of the skins before they are passed along to the second bath. The first bath is usually given in a drum, and after the yellow liquor has penetrated the skins they are removed from the drum and pressed and are then entered into the second bath. A paddle vat is generally used for this bath and the skins are left in over night.

The sulphurous acid which is evolved in the second bath by the union of the hyposulphite of soda and muriatic acid when not thoroughly washed out causes the leather to become stiff and papery after

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being dried out and finished. The presence of any free acids in leather causes it to be weak and tender.

This unpleasant feature of the two-bath process is not present in one-bath liquors—they being neutral or nearly so.

After the skins have been washed to free them from the salts or acids they are drummed in a solution of sumac, gambier or hemlock extract. These materials give up tannic acid, which acts as a mordant for the aniline dyes. These vegetable tannins have a tendency to open the pores of the skins and when too much tannin is applied the skins are made tender and the grain rough, besides causing imperfect coloring. Sumac extract, containing very little coloring matter, gives the best results when the leather is to be colored light shades.

Chrome-tanned skins must be colored before they are dried out, as the water-repelling quality of the leather makes it almost impossible to color it after having been once dried out. The basic anilines are best adapted for chrome leather.

After being dissolved the dyes should be strained and added to the skins in a drum through the funnel attached to the gudgeon of the drum. After the color solution has been added, the leather should be drummed for twenty minutes in order that the coloring material may be well and evenly taken up and developed. As a general thing, only the best grades of skins are worked into colored leather. When they have been tanned, they are sorted and the finest grained ones are colored the fancy light shades and the skins that show any defects are dyed the dark colors. The smoother and clearer the grain is the better are the results of coloring.

Cleanliness is absolutely necessary when good, salable leather is wanted. The methods employed in finishing chrome-tanned calf-skins are the same as are used upon other kinds of skins. After the skins are tanned they will stand a great deal of heat without injury.

Various articles are used as fat liquors. Solutions of alkaline soft soaps are used. These are mixed with neatsfoot and cod oil and upon heavy skins degras is sometimes used. These materials are boiled until a complete emulsion is produced. A small quantity of egg yolk is also mixed in.

A pin mill drum is heated with live steam to a temperature of 125 degrees and the leather is thrown into the warm drum. It is drummed for a few minutes in order to warm it up.

The fat liquor is next added to the leather, without stopping the

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drum, through the funnel attached to the hollow gudgeon. After drumming for from thirty to forty minutes the oil and soap solution will be found to have penetrated the leather. In order to give the fat liquor chance to combine with and nourish the leather, the skins should be thrown over horses or laid out flat, grain to grain, and flesh to flesh, to press and drain for some hours.

After being thoroughly struck out, a light coat of glycerine is applied to the skins on the grain side and this is followed by a light coat of oil. The skins are next stretched in frames to dry, and after they have become thoroughly dry and stiff they are packed down in damp sawdust in order to soften them for staking. After staking in moist condition the skins are partially dried again, staked and then dried thoroughly. The leather is now ready for the final finishing process.

Some chrome-tanned calfskins are finished in a dull, smooth finish; others are glazed until they resemble patent leather; and others are grained or soft boarded.

The glazed skins have taken the place of kid to some extent. In order to produce a salable article the tanner must use considerable judgment and caution throughout the entire process. These can only be acquired through experience. American manufacturers lead the world in the making of fine shoe leathers, and they richly deserve all the success they have achieved.

The writer recently saw a lot of colored chrome-tanned calfskins that were not as they should have been. Instead of being tough and strong as such skins generally are they were weak and tender and could be torn as easily as sheepskins. They were also very soft and lifeless and the color was very imperfect. Not only was the leather streaked and spotted, but the colors were very dingy and altogether undesirable. The color man could not explain the cause of the trouble and the tanner was sure that he had given the skins the same treatment that he had given all the skins, the larger part of which were coming through in nice shape.

The skins had been bated in a manure bate and tanned by the two-bath process. The foreman of the beamhouse was a practical man, but one of the hard-headed kind who consider they have nothing to learn.

The combination of serious defects made it a hard task to determine what had caused the trouble. Upon a close investigation it came

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out that the skins had been placed in the manure bate upon a very warm day, and before the operator noticed what was taking place the bate began to putrefy and "turned." The result was that a great deal of skin substance had been dissolved and removed and the leather thus made open and spongy.

Then, after the tanner had tanned the skins, he failed to thoroughly wash them and the acid remaining in them was the cause of the poor coloring and weakness of fibre. The introduction of one-bath chrome liquors has done much to simplify chrome tanning. Such liquors are safe to handle and their use is attended with no unpleasant after results. They can also be kept for an indefinite length of time without spoiling or deteriorating in quality.

CHROMED CALFSKINS.

First soak for forty-eight hours and flesh by machinery. Then put in lime for six days, using one and a half barrels of lime for 150 calfskins. When the skins are well unhaired, wash them in a mill for half an hour and put them in manure bate. When sufficiently treated, flesh again and put in a pickle. For 100 pounds of wet skins, beam-house weight, use 5 pounds sulphate of alumina, 7½ pounds of common salt, 3 pounds of sulphuric acid, and 6 gallons of water. The pickle should be warm and the skins worked in it until they are struck well through. Then press and dry them, after which mill and split or shave and trim. When shaved, return the skins to the mill and wet down as follows: For 100 pounds of skins, use 5 pounds of common salt to 6 gallons of water. Handle in this solution for about ten minutes.

To tan 100 pounds of pickled calfskins, dissolve 6 pounds of chrome, and run the stock in this liquor for about two hours. Let them remain in the solution during the night and work them in it again for half an hour in the morning. Next place them in a pile upon a horse for a period of twenty-four hours. Then give them a bath (at 68 to 70 Fahr.) composed of 15 pounds of hyposulphate and 4½ pounds of muriatic acid. Handle them for half an hour and again place them in a pile. The following day wash them in cold water for one hour and then in water heated to 120 Fahr. for another hour. The skins are now ready for fat liquor.

Heat the stuffing drum with live steam and run the leather in the mill. Then add the fat liquor at a temperature of 140 Fahr. The solu-

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tion, of which 4 per cent. of oil for 100 pounds of leather is sufficient, should be composed as follows: Three pounds of fig soap, 3 pounds of English sod oil, and 1 pound of neatsfoot oil.

The leather is now ready for black or other coloring. Taw out and finish in the usual manner.

MANUFACTURE OF BOX CALF.

In the making of box calf both the one-bath and the two-bath chrome processes are used. Some box calf is started in chrome liquors and then finished up in gambier or some similar tan, making the combination process. The leather produced in this way is often preferred to the straight chrome tannage, since it does not afflict tender feet. The two-bath process required the use of two acid baths to complete the tanning; the first containing a solution of bichromate of potash and muriatic acid and the second containing a solution of hyposulphite of soda and muriatic acid. Bisulphate of soda is sometimes used in place of the hyposulphite of soda; and when it is used no acid is added as the bisulphite is charged with acid to begin with.

In the first bath chromic acid is deposited upon the fibres of the skins and this is changed to chromic oxide in the second bath.

Absolute freedom from lime is necessary, as lime left in the skins is changed to sulphate of lime, and this closes the pores of the skins, retards the tanning and interferes with the coloring and finishing.

The result is hard, brittle and rough-grained leather. The first bath may be given in a drum or in a paddle vat. Sometimes the skins are taken after the last washing and pickled in a solution of salt and flour and alum. The object of using these articles is to plump the skins and to prevent them from drawing or contracting during the tanning, also to keep the leather from springing back while being struck out after tanning.

The quantities of chrome and acid may be varied. There is no fixed rule. Practical tests are the best teacher.

Usually, however, about 5 pounds of bichromate of potash and 2½ pounds of muriatic acid are enough. Sufficient water must always be used to enable the skins to process nicely.

The skins should be drummed or paddled until the yellow liquor has thoroughly penetrated every fibre, and after being taken from this liquor they should be allowed to draw or season for some hours before being put into the second bath.

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Chromic acid is sometimes used, and when it is used no muriatic acid is added. It is well to add some salt to the chrome liquor. Its use not only plumps the skins, but helps in getting a soft leather.

The drumming of the first bath takes from thirty minutes to one hour, depending upon the thickness of the skins. When the bath contains too much acid the skins swell very rapidly, until they look like pieces of India rubber.

Sometimes 4 pounds of bichromate of potash and 2 pounds of muriatic acid are used. The yellow liquor should have penetrated the thickest part of the skins before the stock is removed from the liquor. Carelessness at this point will result in poor leather.

THE SECOND BATH.

When the process is completed the skins are taken out of the drum and struck out, or, in order to save time and work, they may be pressed and all the surplus chrome liquor removed from them. They are then ready for the second bath. A paddle vat is usually considered the best for this part of the process.

Enough water to cover the skins is run in and to every 100 pounds of skins from 10 to 15 pounds of hyposulphite of soda is dissolved and poured into the vat. To this is added from 2½ to 3 pounds of muriatic acid. The addition of the latter causes sulphurous acid to be evolved, which is the active agent of the second bath.

The pressed skins may be dipped singly into a weak reducing bath in order to accomplish a slight surface reduction, or they may be entered into the second bath at once.

By means of the paddles on the vat the liquor is constantly stirred and the skins are thus kept in constant motion. It usually takes from twelve to eighteen hours to complete the process, thick skins, of course, requiring more time than thin ones. The sulphurous acid changes the color of the skins from yellow to a greenish blue.

Chemically considered, a reduction takes place, the chromic acid of the first bath is reduced by the sulphurous acid to chrome oxide.

By this method the chromic oxide, which is the tanning agent of the process, becomes fixed on and in the gelatinous fiber of the skins and leather results. As soon as the yellow liquor has entirely disappeared and the skins have assumed a uniform greenish-blue color through and through the skins are tanned.

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ONE-BATH PROCESS.

When the one-bath process is used the method of handling the skins is radically different, although the results are much the same.

Before tanning the skins may be pickled in a solution of sulphuric acid and salt. They are left in this for some hours or until it is certain that the skins are pickled through and through. The most unpleasant feature of the one-bath process is the liability to draw the grain. Considerable salt must always be used.

When a paddle vat is used a very weak liquor is used at the start. As the skins absorb the tanning material the bath must be strengthened by the addition of more chrome liquor until toward the end of the process, when the bath should be made fairly strong. This method requires about two days to complete the tanning of the skins.

One important point is that from the time the skins begin to tan no backward movement should be allowed to take place. When left too long in a weak liquor the skins are liable to fall and to lose their plumpness and to tan out thin and barren. Enough tanning material must be used to enable the skins to grow into plump and lively leather.

DRUM TANNING.

Drums are also used in tanning; the liquor being a great deal stronger. Usually it requires about 3 gallons of tanning liquor diluted with twice its volume of water and about 10 pounds of salt to tan 100 pounds of skins.

The drumming takes from three to four hours, although it is good practice to let the skins lie in the liquor over night, so that the salts taken up by the pelt will have time to act upon the fibers. The one-bath process, although much less complicated than the two-bath and much safer to handle, nevertheless requires a great deal of careful attention to turn out a salable article. The methods of handling the skins in the beamhouse are also of great importance, as are also the finishing and currying processes, such as liquoring, coloring and glazing. Calfskins, being baby skins, require very careful handling, especially in the limes and drenches.

The soaking process requires some attention also. The best results are gotten when clean, fresh soaks are used and the skins thoroughly softened and cleansed. It is just as important that a clean surface be presented to the limes as to the tanning liquors.

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When skins are tanned in the combination process, gambier is largely used in connection with chrome.

Among the processes used in making smooth glazed and dull calf other than chrome, gambier, quebracho and palmetto are used. Sometimes these tannages, which are all rapid tanning, are combined with tannages of slow tanning and in this way one supplements the other. No matter which method is used, either one-bath or two-bath, in drums or puddle vat, it is very important that the tanned leather be thoroughly washed before any attempts are made at coloring or finishing.

WASHING.

A solution of borax is used for the first wash and the leather is washed for twenty or thirty minutes in either a drum or paddle. Then clean cold water is used and the leather is washed for fully an hour longer, or until it is perfectly neutral to the taste.

The corrosive acids of the two-bath process, when left in the leather, cause deterioration of quality and strength to such an extent as to seriously impair the value of the leather.

While there are no free acids in the one-bath method, the salts, common and chrome, should be thoroughly washed out before the leather is further treated or dried out. After coming from the wash the leather is struck out on smooth tables with glass slickers. Sometimes machines are used instead of hand labor. The water is thus exuded from the skins, they are made smooth, and a slight gain in measurement is obtained.

IMPORTANT DETAILS.

After this the skins are shaved and all uneven and thick parts are leveled down until the leather is of uniform thickness and has a smooth, clean flesh. Very heavy skins are frequently split before tanning and two pieces are thus obtained; the grain side being used for shoe purposes and the flesh side finished into glove leather.

While the skins are being worked through the beamhouse every precaution is taken to prevent the loss of any of the skin substance, which would cause a thin and lifeless leather. A gradual liming from a very weak lime up to a strong one is generally used. This seems to remove the hair and to gradually swell the skins without injuring the grain or impairing the texture. Old arsenic limes are best to use at the start, and fresh clean limes towards the end of the process.

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All salt and dirt should be removed from the skins before they go into the limes. The cleaner and softer the skins are when being limed, the better can the lime do its work.

A firmer and better filled flank is produced by using the glove or calf kid tannage previous to applying the one-bath liquor. The flour that is used helps to plump and fill the leather. It also prevents the grain from breaking coarse and gives the grain a softer, smoother feel.

It is the common practice among tanners of box calf to stretch their skins in frames or to tack them on boards immediately after coloring and fatliquoring, and to leave them in this condition until they are thoroughly dry. Then they are packed down in damp sawdust and staked twice or three times until they are thoroughly softened. While this method increases the size of the skins, it draws out all the plumpness and fullness of the leather and is one cause of thin and soft sides and flanks.

The two-bath chrome process is now pretty well known, and yet many tanners have a great deal of trouble in manipulating it. Regarding the finishing of chrome tanned skins, the most important point is in the fatliquoring. Enough fat liquor must be given to fully nourish the leather. When more than this is given the leather cannot be suitably glazed and can never be considered No. 1 stock. On heavy skins the use of degras in connection with the soaps and oil is recommended.

SEASONING.

Before a good clear finish can be gotten the grain must be cleared of all grease and the seasoning must be rubbed well down into the leather. The leather should then be dried in a warm, clean room and glazed while warm. The glazing machine brings up a deep black gloss. It usually requires two or three applications of the glazing liquor and two or three workings on the machine to finish the leather as it should be.

A good seasoning is prepared as follows: Five ounces of copperas and 5 gallons of fresh logwood liquor are mixed together; to this are added 2 pints of blood, 5 ounces of glycerine and 8 ounces of ammonia. Before the last coat of oil is applied to the grain before drying out the water should be well struck out of the leather and the oil warmed before using. In this way the oil can readily penetrate into

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the body of the leather, where it will stay and add strength to the fibers.

CHROME TANNING.

Most of the tanners of light skins who have made a success of chrome tanning sort their skins in the beamhouse into three grades, according to weight—light, medium and heavy.

Each class is treated by itself, and the advantage of the sorting is noticed in the much more uniform quality of the leather than would be produced were mixed lots of skins treated without sorting. Some skins are open and porous, while others are of close, tight texture, and if both kinds were treated together exactly alike, the finished leather would be uneven in texture and quality. The former class absorbs more lime than the latter class, while the close-textured skins will stand a much lower drenching without injury than the open and porous ones.

After the final washing some tanners pickle their skins in alum and salt in order to plump them. About 3 pounds of sulphate of alumina and 6 pounds of salt is a common formula for soft skins. Hard skins may be given more of both alumina and salt. Although sulphate of alumina is a tanning agent, it does not act as one in this case, since it is all washed out before the leather is dried out. Alum or sulphate of alumina does not tan the skins unless it is dried in.

After being drummed in the alumina and salt the skins are horsed up and allowed to drain for some time—the longer the better. They improve and will eventually grow into much nicer leather by this procedure.

OVERCHROMING.

Many tanners find their greatest trouble with the two-bath chrome process lies in the tendency to overchrome the skins by using too strong liquor in the first bath, and thus make the leather tender. The quantities of bichromate of potash and muriatic acid must be carefully determined by the character and texture of the skins. The proportions of each article must be very carefully adjusted. The rule of thumb cannot be followed. When the bath contains too much acid the skins swell up very rapidly until they look like pieces of India rubber. Chromic acid is a powerful oxidizing agent, and its effects are not always noticed until the leather is finished, and sometimes not until it is made into shoes.

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The one-bath liquors are handled in much the same manner as bark or sumac liquors—that is, the skins are started in a weak liquor, and this is gradually strengthened to the necessary strength. The object of using a weak liquor at the start is to prevent the astringent liquor from drawing the grain of the skins.

The advantage of sorting the skins into grades according to their weight and treating each class by itself must be clear to anyone using the one-bath process. When the skins are nearly all of the same thickness, after being in the liquor a certain length of time they will be found to be uniformly tanned, whereas, if some of the skins are thick and heavy and others are thin and light, the thin ones will be tanned through in a much shorter time than the heavy ones. A saving of time and labor will be accomplished by judicious sorting of the skins before tanning. A liberal quantity of salt should be used in the chrome liquor. It not only keeps the skins open and plump and receptive to the tanning liquor, but also hastens the tanning process, besides helping to make a softer leather.

A 2 per cent. liquor is usually used at the start, and this is gradually strengthened until it becomes a 4 or 5 per cent. solution; that is, 4 or 5 gallons of the concentrated tanning fluid added to 100 gallons of water. Soft water should always be used, as hard water contains too much lime and magnesia. When the skins are perfectly clean and free from lime and dirt, they begin to absorb the tanning material at once, and thus gradually assume a green or blue color, and the liquor slowly loses its color. In order to have the skins grow into plump leather it is necessary that more tanning fluid be added to the bath from time to time, in order to maintain the proper strength. Skins left too long in a weak liquor will tan out thin and lifeless. A quart of liquor or a gallon may be added at a time, as the case may require.

DRUM TANNING.

When the skins are tanned in drums the length of time of drumming can be easily regulated when it is known that the skins are uniform as regards thickness. When a mixed lot of skins is drummed, by the time the heavy ones are tanned through the thinner ones will have been drummed too much.

When the tanned skins are removed from the tanning bath (when paddle vats are used) there will still be left a considerable quantity of tanning material in the old liquor; this should not be thrown away,

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but a second pack of skins may be entered into this liquor, and the fresh skins will completely exhaust it. A new liquor can then be made and the skins from the old liquor tanned out of the new liquor by strengthening it from time to time.

The skins may be thoroughly tanned in alum and salt and then allowed to press and drain for some time before they are put into the chrome liquor, or they may be hung up and dried out, and after being dry for some time may be put into a drum and washed back, care being taken that every spot is thoroughly softened, as the chrome liquor will not penetrate nor tan readily the dry skin. Then they may be tanned in the chrome liquors. When the beamhouse work has been properly done and the skins are carefully tanned, the leather produced by the one-bath process cannot be told from two-bath leather. There is no stain nor smell to the liquors, and they can be handled without fear of injury. This cannot be said of the two-bath liquors, in which powerful acids are used, which are not only dangerous to handle, but the fumes of which are poisonous to breathe.

The less drumming and pounding the skins are subject to the finer and plumper will be the leather, especially along the sides and in the flanks. Goatskins, being of tight texture, may be satisfactorily tanned in drums, but better results are gotten when paddle vats are used.

For hides and calfskins the best method is suspension, as the stock is subjected to no pounding nor agitation whatever. It costs a little more to tan hides by suspension as a large quantity of liquor must be made up, but after one pack of hides are taken out another pack can be put in and the entire strength thus be exhausted. The suspension method is cheaper in the long run.

FATLIQUORING.

The most important place in the whole process is the fatliquoring, as a great deal of the softness and texture of the leather depends upon how the fatliquoring is carried out. After the skins have been shaved they should be sorted again. When a mixed lot of skins are fatliquored together, the lighter ones absorb more grease than they require and come through too soft, while the heavier ones do not absorb enough grease.

Excessive drumming of the skins before tanning not only tends to make the leather loose and open, but even after tanning it is not

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good practice to drum the leather any longer than is absolutely necessary.

When the coloring is done in a drum a drumming for twenty minutes is generally sufficient for most skins to enable them to absorb the dye evenly and to enable the color to be uniformly developed.

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Grain and Side Leathers.

THE MANUFACTURE OF GRAIN UPPER.

When a pack from the bate is worked on a table with a stone, a bolster is not used on the table. The table for this purpose is well jointed and smoothly dressed on the face. A common scouring stone rubbed so that the face, which is common to both edges, is level and the side of each edge level also, is used. The corners of the stone are well rounded to prevent the grain from being marked by them. A tanner's knife, ground to a thin edge and cleared on a fine stone, is used to shave off short hairs that cannot be removed with the stone. When using the knife the workman presses the side against the edge of the table by leaning against it and holding the part of the side showing short hairs up from the table with the left hand, takes the knife in the right hand and shaves off the short hairs. The knife cannot be used so skilfully, in removing short hairs, when the side lies flatly on the table, as when it is raised from the table.

STONING.

Things being ready to work a pack from the bate on the table, take a side from the pack and place it upon the table butt first, grain up, and drawing enough of the head end over the front edge of the table for the workman to press against to hold the side in position. Having the side properly on the table, take the stone and, beginning at the straight edge, work a course across the neck reaching out on the side as far as is consistent with good work, then draw enough of the side over the edge of the table to bring another course within reach, and beginning at the straight edge work a course across to the flank and shank. Leaving the flank and shank, draw enough of the side over the edge of the table to bring another course for working within reach, and, having worked this course, repeat the operation till the butt end is finished; then turn the side end for end on the table and work the flank, shank and head. This done, throw the side into a soak of clean

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water or into the bate again, as the case may be, and proceed with the work till all the sides are finished and placed in the soak or in the bate.

Placing the side on the table lengthwise, and stoning it similar to what a tanned side is in the scouring process, is a speedier way of getting over the work. But the work cannot be done as well as when the side is placed endwise on the table. When it is placed lengthwise on the table, it is not possible, without considerable trouble, to work the side the way the hair lies naturally, which must be done to insure a good result. Workmen who follow this method place the side lengthwise on the table, with the straight edge hanging two or three inches over the front edge of the table. When beginning to stone a side, the workman stands on the butt side of the imaginary line which runs across the side at the center of its length, and stones the head half of the side first. Then he stones the butt half of it. While stoning the side the workman manages to shift its position on the table by working it far enough back on the table to bring its straight edge upon the table for working.

Now, there is danger of chafing the grain when working a side with a stone, and to avoid injuring the grain the workman delivers the first stroke on every part of the side with light pressure.

WORKING OUT THE FLANKS.

In the manufacture of grain leather the flanks give considerable trouble in the finishing. In working the flanks in the beamhouse care should be taken not to work them crosswise instead of lengthwise. For instance, if a beamsman works the front flank away from the shank instead of working it in line with the shank he injures the flank irreparably.

One working on the grain is considered sufficient by those tanners whose aim is to shove stock through the beamhouse with the least expense. But with those tanners whose aim is quality, one working is not considered sufficient, and the pack goes back into the bate and remains in it from half a day to a day. Then it is worked again on the grain and placed in clean water, when it is ready for the liquors.

BATING.

There is no rule to go by in bating stock in these days. Tanners do not judge by the state of the stock, as to whether it is fit to go to the liquors or not. They give a pack a certain number of hours in the

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BEAM HOUSE WORK.

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bate, and then work it, no matter whether it is well bated or not. It must be worked and placed in the liquors; for the next pack is crowding it. This way of bating makes inferior leather. So far as the graining is concerned, it will do passably well where stock is printed, but it will not do where stock is grained by hand.

Stock for grain leather is hung or suspended in the liquors, to color and tan the grain. There are several ways of suspending it in the liquors. Of these we may mention three, viz.: in a rack, tacked to sticks, and fastened with strings to boards, which are nailed to the ends of the vat below the liquor mark and which have rows of nails driven in the upper edges. Of the three ways mentioned, the rack is preferable, for a pack comes out of it in better shape than it does out of either one of the other two.

SUSPENDER RACKS.

A rack is made of 4x4 scantling—oak preferably. It is an oblong square, two inches less in width that the width of the vat, and four inches less in length than the length of the vat. Supposing a vat is four feet six inches wide, a rack four feet four inches wide will fit and work properly in it. In a rack of this width a pack of fifty-two sides can be hung an inch apart, or sixty-five sides three-fourths of an inch apart. The latter space is sufficient to admit of the stock coloring properly, when well attended to. Often sides are hung only half an inch apart in the rack; but this is not advisable. For, when sides touch one another in place, they will not color and tan at the point or points of contact.

There are, in so many tanneries, racks which are racks only in name, and which will not admit of the liquor being changed on the stock, and we deem it necessary to describe the way to make a substantial rack. Take two pieces of four-inch by four scantling, oak preferably, each piece four inches less in length than the length of the vat, and two pieces of similar scantling, each two inches less in length than the width of the vat; frame these pieces of scantling so as to form an oblong square, by letting the end and side pieces half way into each other at the ends, and fastening them together with wooden pins. In framing the scantling, the long pieces are cut on the top side, and the short pieces on the bottom side, so that the end pieces rest on the side pieces when the rack is framed; otherwise the weight of the pack will disunite the end and side pieces. A single piece of similar scant-

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ling which, in length, corresponds to the width of the vat or nearly so, is placed across the rack at the center of it, lengthwise, and is fastened with iron bolts which enter at the bottom side of the rack and have their heads countersunk. The piece, being longer than the width of the rack, will extend nearly an inch over each side of the rack. These ends of the center piece are rounded on the bottom side back to the side pieces of the rack, so that the rack will rock easily when it is placed in position in the vat and a pack hung in it. Having joined the pieces of scantling together, stand to one end of the rack and draw two lines two inches apart, on the top side of the end piece from one end to the other of it. The one line is an inch in from the outer edge of the top side of the end piece, and the other line is an inch in from the inner edge. Now, beginning at one end of the end piece, draw lines an inch apart across the top side, until the whole length of the piece is marked into inch spaces, then, on the inner line which runs the whole length of the end piece, place a peg or nail at the point where it and the first cross line cut each other. The next peg or nail is placed on the outer line which runs the whole length of the end piece, at the point where it and the second cross line cut each other. The work is continued till a peg or nail is placed on every cross line, but on the inner line and on the outer line alternately. Corresponding pegs or nails are placed similarly in the opposite end piece, which completes the rack.

Now take two pieces of slim inch oak board, each ten inches wide and eighteen inches long, plane them on both sides to reduce their thickness an eighth of an inch, hollow out one end of each piece so that the rounded ends of the cross piece of the rack will fit in them and, taking the center of the length of the vat, nail the two pieces of boards, cyndrical hollow ends upwards, one on each side of the vat at the center of its length. When nailing the boards to the sides of the vat, care is taken to place them so that they will not carry the rack above the liquor mark. The boards being nailed to the sides of the vat, place the rack in the vat so that the ends of the center piece rest in the hollows made in the ends of the boards, when it is ready for hanging in a pack.

GRAIN LEATHER EXPERIENCE.

In finishing we soaked, skived and split the leather to say 4 or 5 ounces per foot; then scoured flesh and grain by hand. After the hardening we set the sides out, with just a little water on the table to make it stick a little.

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Next, we placed the leather under the pebbling jack, which made a round print like small shot. Then we oiled the table, put the side grain down and set it on the flesh, applied a good coat of oil and hung up.

When dried the sides were taken down, blacked and sponged over with a mixture of blood and logwood water, then boarded up straight and hung up again. After a short time the sides were thoroughly soft boarded until very flexible. The blood and logwood were again used and leather suspended for drying. Once more it was removed, polished on the jack, boarded on the flesh, then two ways on the grain, oiled with hot oil and dried out.

Now let me show how very differently the business is conducted today. Most of the curriers tan their own grain leather, and the advantage of this is apparent. The best hides, in my opinion, for grain leather are slaughter stock of good spread, weighing say 45 to 50 pounds. I believe in liming high and bating low for polish or imitation goat. Low bating produces that desirable soft feel, and keeps the grain from breaking up in pieces. The old style was to oil in setting, but the wheel-stuffing is a great improvement on all kinds of grain leather.

In stuffing do not let the grease in the wheel become warmer than 100 degrees. Half a pound of fish oil and ¼ of a pound of degras per side is enough. In setting, oil the table to make it stick, and after putting twenty-five sides through this process, clean up the table and set hard on the flesh.

By stuffing in the wheel you get more measure than by setting without; a finer grain is also secured.

RECIPE FOR BLACKING.

Take 25 pounds iron turnings, ½ pound of acetic acid, 8 pounds of copperas, and dissolve in a 42 gallon barrel of water. The turnings will last a long time by filling up with a good oak liquor, or gambier or hemlock liquor. After blacking the sides, you can obtain better results by laying them down grain to grain and covering up at night. This pile should be turned over and pebbled on the following day.

Boarding may be done in many ways. I think the best method is to use a jack and board from tail to head and head to hind shanks.

After the sides are dry they are ready for a good heavy coat of blood. Some tanners use a material called "levant," a kind of artificial

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blood, but I prefer the original stuff. A few blood twice and polish twice, but in my opinion that is useless. There is no danger of the finish breaking if you put one gill of oil of glycerine into one pail of your finish. Before using the polishing wheel, go over lightly with a swab of sheepskin on which has been sprinkled a few drops of oil. This saves any smearing after being polished. You now soft-board on the grain side from belly to back, then straight up; but that depends on the figure of your roller.

COMBINATION TANNING FOR SIDE LEATHERS.

Take the sides after they have been in the bark tan liquor or the hangers for four or five days so that the grain is about struck through, put them in a wash wheel and leave there for fifteen or twenty minutes with clean cold water running on them to wash the bark liquor from the surface. Then press the sides as usual before splitting. Mill well after pressing so as to loosen the fiber and soften the press marks. Now skive with belt knife or by hand and split to the required substance, about three or three and one-half ounces.

SPLITTING.

The splitting on this kind of stock can be done on the union machine with better results than on the belt knife, as the union machine gives more measurement and the leather does with less shaving. The belt knife may be used if required and the splits returned to the bark liquor after being milled with strong bark liquor. This will give the tanner the benefit of the split being all bark tanned.

The grain sides should be processed as follows to prevent the leather from plumping more in one part than another while tanning and to leave the stock with a strong fiber:

RECIPE FOR MILLING PROCESS.

Take five common pails of salt, and ten pounds of soap, two and a half pounds borax, three pounds sulphur, two pounds baking soda, in common oil barrel, which should be filled one-third full of water, and then well boiled. While cooking add twelve gallons of paraffine oil. When these materials are well dissolved, fill barrel with cold water and stir thoroughly.

Now put fifty sides in the stuffing wheel. Heat both the wheel and the solution a little, add five pails of solution to the fifty sides.

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Run for twenty or twenty-five minutes and let them lie in a pile for four hours after milling; then they are ready for the tan.

TANNING RECIPE.

For 100 sides, boil 85 pounds gambier and 35 pounds quebracho extract in sufficient water to dissolve thoroughly. In a separate tank dissolve 18 pounds alum, 35 pounds salt, 5 pounds borax, 15 pounds sulphate of soda and ¾ pound of picric acid.

While boiling add three gallons paraffine oil. After all is dissolved mix in one tank and add one pint sulphuric acid.

Now make up the liquor for 100 sides in a paddle wheel vat. Keep the liquor at 12 degrees barkometer and 70 degrees heat and the sides will be tanned in three days.

When tanned, wash in wheel a little, press well and soften sides in mill, then shave. After shaving they are ready for the re-tan.

RECIPE FOR RE-TANNING.

To re-tan take one oil barrel full of gambier liquor at 30 degrees barkometer and to it add 1½ pints muriate of tin, ¼ pound of tin crystal, and 1½ pounds tumeric. Take six pails of re-tan for each 50 sides; the strength should be 70 degrees. Heat the mill, which must run two hours to re-tan thoroughly. After the stock is moved from the wheel rinse in clean warm water and let drain over a horse over night, when the sides will be ready for fat liquor.

RECIPE FOR FAT LIQUOR.

For fat liquor, take 10 pounds degras, 2 gallons sod oil, 2 gallons cod oil, 3 pails soft soap, 2 pounds borax, 2 pails water to each 50 sides of leather. The wheel and fat liquor should be heated to about 120 degrees and let run until the leather has absorbed the fat from the water, when the sides must be hung in a hot room to dry as fast as possible. After they are dry mill in lukewarm water so as to damp them ready for setting out. If intended for dull finished dongola or kangaroo finish, they should be blacked before setting. If intended for bright polish they should be set and re-dried before blacking. If wanted for smooth or boarded polish, the sides should be set out very tightly on both sides.

This process produces a fine grain and a very tough fiber if instructions are followed carefully. The stock can be finished either in a dull

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boarded grain with the same process as any other combination tanned stock, or it can be finished in a bright polish, boarded or smooth grain of high quality.

SATIN OIL LEATHER FROM GREEN SALTED HIDES.

SOAKING.

The utmost care and attention should be given to the soaking of hides for satin leather, as results wholly depend on the preliminary work. The hides should be soaked about three days, care being given to those that show any tendency to slip or run on the grain. Then flesh and throw back into soak over night, keeping the soaks down to as low a temperature as possible.

LIMING.

Now join, or as tanners say, toggle the nose of one side to the butt of next; it is well to lime the hides for six days, using about one barrel of lime per day for every hundred and fifty pounds of hides. A very small quantity of sulphide of sodium can be used successfully with each barrel of lime, care being taken to plunge the lime vat well before placing the stock in the limes, so as to thoroughly impregnate the water with the lime.

UNHAIRING AND BATING.

After liming the hides it is well to place them in a bath of 60 or 70 degrees water and run them through the unhairing machine, then throwing them in a mill or drench. Very fine results have been obtained where a lactic acid bate is used, twenty minutes to one-half hour being long enough for this operation, after which work out of bate and throw them in a bath of cold water, the colder the better, getting the hides thoroughly chilled if possible.

HANDLERS.

After tacking on the hides it is well to suspend them in an old liquor almost 6 to 7 degrees barkometer strength, changing the position of the hides after lying in the liquor about three hours, then strengthen the liquor every day for eight days until your liquor is up to 12 degrees of strength. After that it is well to keep your liquor up to 15 or 20 degrees of strength, tanning them in about twenty to twenty-four days.

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SPLITTING.

After dampening and splitting your stock, send splits back to the yard, using a 20 to 24 degrees liquor for twelve to sixteen days to re-tan them.

MILLING.

You can now take the grains and place in mill or pin wheel, making a 30 degree gambier liquor. To every fifty sides, use six pails of the liquor heated to blood heat, being careful to mill until the liquor is well into the stock.

PACKING DOWN.

Now pack the stock down for two days and cover up.

COLORING.

Place the stock in mill or pin wheel, taking two pails of water into which has been dissolved one-half pound of violet aniline and one pint of copperas water and mill for twenty minutes, then hang up to dry. Now, after properly dampening the stock, pack down back to belly four days.

STUFFING.

After touching up any dry spots, heat your mill to 150 degrees and heat your grease to 150 degrees, running your stock for twenty minutes with one door closed, then about forty minutes with the door out of the mill; after this operation it would be well to hang up for fifteen minutes.

SETTING.

Now take the stock to a setter, letting it lie in a pile over night, having it set on flesh and also on the grain, after which hang up to dry until it is ready to stuff and go to the finishers. The remainder of the process I will only designate as stuffing, blacking, rolling, drying out, staking, seasoning, finishing, measuring and rolling up.

In regard to the stuffing it is well to consider the tannage and firmness of the leather and results required, and I will submit a stuffing that has always given good results:

55 lbs. good degras.
20 lbs. stearine.
15 lbs. hard grease.
8 lbs. paraffine wax.
2 lbs. paraffine oil.
33 to 35 per cent. of grease to the weight of wet leather.

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GLOVE GRAIN.

In selecting sides for glove grain it is best not to take any over sixteen or eighteen feet in area, in fact none should be over twenty feet for any kind of grain leather. Tanners will find it to their advantage, when sides average twenty-two feet, to put them into boot, oil and plow shoe grain. This is a high average. Twenty feet is not out of the way for grain. Light sides with poor flanks and thin shoulders might be finished into 5 ounce oil grain. This culling will leave a run of sides of uniform substance and give a finishing split. If the side is heavy enough to split 6 or 7 ounce to the foot you can put that to plow shoe. If the flank and shoulder are good you will have a nice grade of 8 to 10 ounce boot grain.

To secure desirable grain leather, tanners must not omit to do their share of the work, particularly in the limes and bating. When this is thoroughly done, the currier has then a fair chance to finish properly.

After splitting and taking out the machine marks by the shaver, in case the grain is fine, the flesh only need be scoured, unless the grain is bloomed. That will help the measure and brighten the flesh. After being dried, dip the day before the stuffing. The material for each lot for the wheel should be weighed, and flanks and shoulders damped just before the stuffing.

To make leather feel just right, it is well to give 20 parts of degras, 20 of tallow and 20 of paraffine wax to each 100 pounds. If the tannage is of a solid nature, take 10 pounds paraffine wax and 10 pounds cod oil extra. Do not set the grain till next day unless you hang the sides to chill. In setting warm you do not get the stretch out of the grain. Suppose you take twenty or twenty-five sides. Clean up the table and set hard on the flesh, leaving no slicker marks, as they would show all through the finishing.

Before blacking, the whitener should take the sides and lay them out flat. Some tanners buff only the bad spots on necks, but by buffing all over you get a more uniform finish and there is less danger of the leather cracking.

WATERPROOF SEAL GRAIN.

Leather intended for seal grain must be unhaired very carefully and properly in the beamhouse.

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See that all the fine hairs are removed, as good work in this direction will be appreciated when the leather comes to the buffing department, as all seal grain which is made on up-to-date methods has the grain on it. And I will guarantee that if my suggestions as given here are carefully followed, leather made by any of the quickest and hardest tannages will not crack.

From thirteen to fourteen feet per side is the best size for seal grain. After the leather is split with a band knife, throw fifty sides in a drum (plugs out). Run for five minutes in lukewarm water; then put plugs in, leaving leather still in drum. Add 25 gallons water in which 10 pounds of salsoda has been dissolved at about 100 degrees Fahrenheit.

Drum for fifteen minutes. Remove plugs and wash leather about for, say, five or ten minutes longer, then insert plugs again, and add three pails of sulphuric acid solution, made as follows: To 50 gallons of water add 1 gallon of sulphuric acid, or oil of vitriol, and mix together. If one gallon does not bring the temperature up to 15 degrees by the thermometer, add another quart of acid. Three pails should be about enough, and then the drum should be worked five minutes. Wash the leather with water until the water in the drum ceases to taste acid; then take leather out and scour on machine. Hang up to dry, and take down when bone dry, and put fifty sides in your drum.

Now cook 12 pounds of alum and 5 pounds of salt in 10 gallons of water (lump alum preferred). When all is dissolved, add 35 gallons water. Put this 45 gallons of alum and salt water and the leather into the drum and run for a half hour. If a yellow back is needed, add 1 pound of picric acid to the 45 gallons; or, if you wish, 1½ pounds of aurmine may be used. Either will give a nice yellow back.

After the sides have been drummed for a half hour, remove and hang up to dry. When dry they are ready to fatliquor.

FATLIQUORING.

It may seem strange to some people to talk about fatliquoring dry leather, but I have done this for many years in making seal grain, in the leading tanneries. The leather must be fatliquored when dry, or else the waterproof effect will not be produced.

Make fat liquor as follows: Into a barrel which holds 50 gallons pour 25 gallons of water, and add from 6 to 8 pounds of soda ash,

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and cook ten minutes. Then add 13 gallons of pure moellen degras, and cook for one hour. One gallon of this fat liquor should weigh 8 pounds. It is best to have it made the day before, so it will bleach out nice and white. After being cooked for one hour, fill the barrel up with water, making, say, 50 gallons. Weigh 300 pounds of dry leather and put it into the stuffing mill. The mill should be cool, but the fat liquor should be 120 degrees warm. The barrelful may be given to the 300 pounds of leather. If the drum is not large enough to hold this quantity of leather, take half of the leather and only half the barrel of fat liquor. Or you can take 100 pounds of dry leather and 17 gallons of fat liquor. If you have one-half gallon over it will not hurt.

SETTING.

Fifteen minutes is about the time necessary for drumming. Then remove and hang the leather up for two hours, when it will be ready for the setting machine, which should set them on grain side. Now turn the leather over to the hand setters, and they can set them again, if necessary, on grain or flesh side. The setting should be well done. No tanner should permit poor work. Proper setting means half a foot more leather to every side, and this important advantage should not be lost by the tanner. Give the sides a light coat of good oil after being set, then hang them on sticks or tack on frames. If on frames, there is no need for extra labor in setting, as the frames will take out all stretch in the leather and put it in nice shape for buffing out the imperfections.

When dry, take down and buff out imperfections, leaving sound grain. This is where good work in the beamhouse comes in, as there is a saving of $2 per hundred when leather has been thoroughly unhaired. Now trim, and if the yellow back is not yellow enough, go over the flesh side with a coat of satin made of 3 ounces of yellow dissolved in 3 gallons of water, cooked to 100 degrees Fahrenheit.

BLACKING.

Black on tables, using a sig first. Make the sig by putting a pound of caustic soda and a half pound of carbonate of potash into 50 gallons of water. Use judgment. Reduce the mixture with water if the leather takes the logwood and dyes easy.

The sig is used on sides first with a brush; then slick off and go over the side with the logwood and dry. Better repeat twice, so as to

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get a good, deep black. Set off with copperas water, the usual way. Then wash off the copperas. For making the latter I use one-half copperas and one-half blue stone, making 12 pounds altogether, to 50 gallons of water. Reduce if necessary. Great care must be taken that the leather does not crack on the grain. When the leather is blacked, hang up for a few hours, to harden for printing. Use discretion, so that the sides will not be too wet or too dry. Print or stamp necessary pattern on the leather, then hang over night in a warm room.

Should the leather spew, do not mind this; as it is supposed to spew a little in first drying from the black. The leather is next grained or staked on flesh side and given a coat of oil on grain side, and a coat of dull or bright finish, according as desired by the customers. Some concerns manufacture a blacking that has a good dull finish, if this is wanted.

More soda ash can be used, if desired, in the fat liquor. If the sides have not a dry flesh, the soda ash will not hurt them, but will eat the grease, leaving the leather soft and pliable, and the flesh side is not oily like oil grain.

If the leather is required to be more waterproof, use more alum. Sides treated as above will spew a little, but not much. If there is no spewing, the waterproofing has not been done thoroughly. The finish holds the spew back. Finish in a warm room if possible, and dry thoroughly before shipping the leather. The latter injunction is very important to remember.

BUFF AND GLOVE GRAIN.

There is not much difference in glove and buff, with the exception that the former is finer than the latter. I remember when we took rough leather, skived, split, scoured and hardened it. Then we would damp the dry spots and stone from the shoulder down. After that we turned a low square edge on the currying knife and buff same way that we stoned. Then we set out hard on the flesh side and hand stuffed. When dry we smeared with grain blacking, and after leaving the sides a while, a good coat of fish oil was applied, and they were hung up to dry. When the sides were taken down, we soft boarded and waxed with a soap and paste finish. In those days there were no curriers outside of Massachusetts that tanned their stock as they do now, which is a step in the right direction. With a tannery ad-

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joining the currying shop, the leather can be gotten out to suit the finishers. There is an old saying that a baker cannot make good bread out of bad flour, and this holds good in tanning.

Well, leaving the past to take care of itself, I would say that for glove grain as made today, you want a plumper hide than for imitation goat. Curriers usually make their selection from the yard. For instance, flanky sides give good imitation or light oil grain. Sides with heavy shoulders and good flank are chosen for boot grain, and where the flanks are good on a light side which would split 3 to 4 ounces, this leather might be used for glove grain. Hides weighing from 40 to 60 pounds make better glove grain than larger stock.

In liming and bating them, glove grain hides should not bated as low as for imitation goat, as that would run down the flanks, and make them too soft. If tanners would use, say, 3 pounds of flour of sulphur in their bates, they would get a good pure, without any risk of spoiling the grain. I have been asked how much lime and pigeon manure ought to be used. That depends on how quick you want your hides limed and bated after being soaked in clean water. In summer time a soak should only be used once. Make your lime strong enough to remove the hair so that it slips easily. As a matter of fact, green salted hides will lime and bate faster than dry hides. After unhairing, give them a good drench in the slush wheel with plenty of water at 70 degrees to 90 degrees. I think twenty-four hours is long enough in the bate. Then after being well worked, run again in the slush wheel before putting in tan liquor. It is well to trim and flesh in the beamhouse for all curried stock. This not only saves bark and time, but gives a little glue stock that would be useless if tanned.

Many tanners and curriers split their leather at too early a stage of tanning, and in doing so entail extra cost for shaving. It is time enough to split off a light grain when you can take all the green off evenly. You will then have a fine level surface, and the side before being split should be jacked all over on the grain side, more especially on the heads, so that the natural wrinkles will be removed. After splitting, many tanners flat all over with the currying knife. This is always done on glove grain. If the sides appear loose in the flanks, give them twenty minutes' run in the wheel, with, say, ¼ to ½ pound of japonica for each side in milk-warm liquor. There is not much use in scouring on the grain, but the side ought to get a good scour and flesh, then dry them out.

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RUSSET, PLOWSHOE, OIL GRAIN AND LEGGING LEATHER.

After the leather is split, retan if needed. If fully tanned, put fifty sides in a drum in which should be a mixture or solution of oxalic acid and salt before the leather is put in.

To make this mixture put 2 pails of salt in 3 gallons of water, and 1 pail of oxalic acid in 2 gallons of water. Cook the acid first. Then put the salt in a barrel containing 10 gallons of water. After adding the oxalic acid liquor, the barrel should be filled with water to make about 52 to 54 gallons of liquor. Now take 7 pails of water and 2 pails of oxalic acid and salt solution to a drum of 50 sides of leather. Run in drum fifteen minutes. If the leather is not clear enough on the grain for russet leather add one more pail of oxalic acid in the next drumful. You must use judgment, as tannages vary and some leathers require less bleaching than others. Oak tannage needs less bleaching than hemlock. It is possible to over-bleach leather.

After running the mill fifteen minutes add fresh warm water and run the drum five minutes or more until the leather does not taste of oxalic acid. The plugs are left in the drum for the first fifteen minutes, but when washing out the plugs are removed, so that by degrees nothing will be left in the drum but lukewarm water.

SCOURING.

The sides are next scoured by hand or machine. The latter method is best, as I find that there are fewer iron stains when the machine is used. Scour only on flesh side, then hang up to dry. It is better still, to save time, if the leather can be put in a press and afterwards dried.

When dry, take the sides down and dip them in a tub or vat of clean water. The russet is kept a trifle more on the wet side than oil or grain. I mean that it should have more moisture in it before going to the stuffing mill. This will help hold the color of the russet.

After the leather is dipped, weigh up 300 pounds of leather to a mill. See that the flanks are a trifle wetter than the backs. About 5 pounds of water per side of leather weighing 7 to 8 ounces to the square foot is all right. Turn steam into mill fully five minutes and let the exhaust steam water run out. Place your leather in the drum, and if hemlock-tanned, give 2½ pounds of grease per side. If oak-tanned, the color will be lighter and 2 pounds of grease per side will

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be enough. The sides should average over 16 feet each and about 4 ounces in substance.

STUFFING AND GRAINING.

The stuffing referred to should be made as follows: Two gallons of stearine, 6 gallons good tallow and 2 gallons best brown grease, all mixed in one kettle.

Give 2½ pounds from the kettle to each side. I should have said that each mill load of leather should get 1 gallon of moellen degras. The degras should be well mixed with the grease for each mill.

Run mill for twenty minutes. Let cool for five minutes. Set on both sides of leather and use water on the sides so they will stick to the table while setting. Dry out, then buff the grain so as to get a better selection, trim and color on the grain side. Cook 1½ ounces of cake nonkeen, according to shade, in 1 gallon of water. The less color used the lighter the shade will be. The whole effort is to make the grain or finish look like the natural grain. The leather being buffed makes it look better and will grain up more even in finishing.

Apply two light coats of color with a soft brush and immediately wipe off side with a sponge. Hang up to dry. When in proper shape print and grain three ways, according to softness required. Here is where the finishers notice whether 2½ pounds of grease per side is sufficient; if not, give 3 pounds per side. In order to hold russet color, however, I find it best to use 2½ pounds per side and put some elbow grease in as well. Oil light when setting if needed.

FINISHING.

After the leather is grained, give a coat of finish and hang up over night. To make the finish, dissolve one pound of blood albumen over night in 3 gallons of water. Give sides a light coat and dry well. Then grain one way and give a second finish. For the latter, simply dissolve 6 to 8 ounces of chipped soap in a pail of water. To be right, this should be like soft soap when cold, and should be used cold. If not heavy enough in body, the finish will cause the sides to come out spotted. Hang up until dry, then give one coat of soap finish.

Some tanners make what is known as russet oil grain. This is simply done by taking some of the finished leather, as previously mentioned, and going over it with a light coat of paraffine oil and degras. Take one-half paraffine and one-half good common degras. A good grease and careful bleaching of leather is what is mostly desired.

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In my opinion, oxalic acid is far superior for bleaching to borax and sulphuric acid, as it helps hold substance and weight better and the salt keeps the acid from injuring the leather.

It is not very important how much water is employed in making the oxalic acid and salt solution, as the barrel is filled when the combination is cooked, to a total of 52 or 54 gallons. Then simply use enough solution to produce the russet effect.

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UNHAIRING ON THE BEAM.

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Coloring, Dyeing and Finishing.

PRACTICAL LEATHER DYEING.

In practical leather coloring, the difficulties that the dyer most frequently meets with in his efforts to get clear, deep and uniform shades may be readily divided into four classes:

1. Those troubles that arise from improper methods of handling the hides or skins in the processes of beamhouse and tannery.

2. Thost that spring from faulty preparation of the leather before the dye is applied.

3. Those that are caused by the use of poor grade coloring materials.

4. The difficulties that result from ignorance of the best methods of using the coloring materials, and carelessness or abuse during the actual process of coloring.

In order to get good results in coloring, even with the best dyes, the leather must not only be skillfully handled during the process, but it must be handled right from the very start.

No process nor part of a process can be slighted, for the results gotten in the coloring process depend largely upon the methods employed in the previous processes through which the leather has been worked, as well as by the nature of the materials used in these processes.

CAUSE OF TROUBLE.

One of the most frequently met with defects on colored leather is a shaded, mottled or streaked appearance of the grain. This may be caused by a number of mistakes, but one of the most common is the carelessness with which the skins have been soaked and softened before going into the limes. Light stock, such as sheep, goat and calf skins, when they are received at the tannery in salted condition, require but a few hours' soaking in warm weather and not more than twenty-four hours in cold weather, to cleanse them from the salt and dirt upon them. One point that is often overlooked is that it is just

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as important that a clean surface be presented to the limes as to the tanning liquors. Dried skins, of course, require longer soaking than salted ones, but no matter what kind of skins are used, the best results are gotten only when the water in the soaks is clean and fresh. When soaks are used over and over for a long time the dissolved blood, dirt, etc., begins to decompose, and thus the grain of the leather is often injured. When salt is left in the grain it causes a peculiar clouded appearance. The object of soaking the skins is to get them clean of all salt, dirt, blood, etc., as well as to thoroughly soften them, so that the depilating material can readily penetrate and take effect. When these results are not accomplished the results later on will not be satisfactory. Simple as the soaking of skins is, it is yet one of the most neglected of all tanning processes.

FALSE ECONOMY.

What has been written about soaking applies with equal force to the liming process. In their efforts to economize, tanners often use limes over and over, and the limes so used become in time stale and unclean, and the results are not satisfactory. It is a false economy that saves a few cents' worth of lime and loses dollars because of faulty leather. Gathering limes are only safe so long as they are kept sweet and clean. Unless the skins are frequently reeled from one lime to another, or often stirred about and opened out, they will not lime evenly, and this will cause trouble. Red arsenic and sulphide of sodium used in connection with the lime shortens the time of liming and gives a smoother, firmer and clearer grain. Sheepskins are generally painted with a mixture of lime and sulphide of sodium; the latter is also used frequently alone.

Before removing the hair or wool the workman should be sure that it comes off easily and clean, as the grain is very easily strained by the hair or wool coming off hard.

During the time of unhairing the skins should be kept from heating in the summer and from freezing in the winter. They should also never be allowed to dry out on the grain nor to harden, and the grain should be kept moist and from exposure to the air as much as possible. The bating or drenching process, by which the skins are freed from lime and put into a neutral condition to take the tannage, is always a very important process and unless carefully and properly done will interfere with getting good colors on the grain. It is absolutely neces-

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sary to get rid of every bit of lime, no matter what tannage is used. Softer and more elastic leather will result and the shade of color will be deeper and fuller when no lime is left in the skins.

DRENCHING.

It is the usual custom to give the skins two or three washings before tanning them, in order to get them perfectly pure. Manures are largely used on goatskins. They require careful handling to get good results. After having been brought down in the manure bate it is well to wash the skins for a few minutes in a weak bath of lactic acid before tanning them. Goatskins are very hard, close grained, and need a very severe drenching, while calfskins are very easily injured during this part of the work.

When the bran drench is used, the skins should never be put in until the drench is perfectly developed. An undeveloped drench frequently causes shaded grain. To produce good colored leather the skins must be thoroughly tanned, and no raw material left through the center. The different varieties of skins exhibit very marked differences as regards grain and fiber, and even among skins of the same class there are many distinctive peculiarities. On this account it is very important that before the leather is colored it should be sorted into grades according to the texture and quality of the skins.

SORTING.

In the work of sorting the sorter must use judgment, acquired only by experience, as the grading is largely done by the looks and feel of the skins. All skins of a uniform degree of firmness and density of substance should be sorted out from all loose, light and open skins and colored separately from them. Less dyeing materials are required for the former kind than upon the latter class. The clearest and finest grained skins should be put into the fancy shades and all the skins that show any defects should be colored the darker shades. The more perfect the grain is, the better will be the results of coloring. Some of the small defects which might appear very plainly on light colored leather are often not noticed at all on the darker shades. The more serious the defect, the darker should be the shade given.

Great differences exist between skins as regards their fibrous structure. Some are open and coarse, while others are close and tight textured. Sometimes these differences are the result of the methods of handling the skins, other are natural.

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Each skin requires its own peculiar treatment. Skins tanned in vegetable tannages are usually dried out after tanning and kept in the dried condition for some time before they are colored. It is during this time that the leather improves and becomes softer and more mellow with age. After coloring the leather should be dried out and finished as soon as possible, so as to avoid faded spots.

TREATMENT OF VEGETABLE-TANNED SKINS.

The vegetable-tanned skins, that is, the skins tanned in bark, sumac, gambier and similar tannages, when taken in the dry condition, require a washing before they are colored in order to remove from them any dirt, dust or excess of tannin that has not fully combined with the fiber. At the same time the leather is moistened by the washing and thus put in condition to receive the mordants and coloring materials. When the washing is properly done the shades will be much clearer, fuller and deeper.

When the dried skins are immersed in the dye bath without this preliminary washing, many defects will be noticed in the finished leather. Usually the color does not penetrate nor combine with the fiber and the result is very unsatisfactory colors. The washing is best carried out in revolving drums. Warm water is usually preferred, as it has a much greater softening and cleansing power than cold water. A safe temperature is from 85 to 95 degrees.

SOFTENING.

The amount of treatment necessary to bring the skins into the required condition naturally depends upon their character and the nature of the tannage. Skivers, being very light and tender, require very little treatment and a very careful handling, while goat and calf skin require a much longer preparation. For softening purposes water that is soft and free from iron is the best to use. Much depends upon the kind of water used, both as it influences the rate at which the softening is done and also as relates to the shade of color obtained. The quality of the water used in preparing the mordants and dissolving the dyes has much to do with the results gotten in the coloring process. Very hard water often causes a faded, dingy appearance of the colors, and when such water is used in dissolving aniline dyes it often happens that a portion of the dye settles to the bottom of the vessel in the form of a soft, tarry mass. This causes

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a spotted and imperfect coloring. It is also imperative that the water be clean and free from dirt and other foreign substances. The evil effects of hard water may be prevented and such water better adapted for coloring purposes by adding to it a small quantity of acetic acid. Borax is also used, and being a gentle alkali, helps somewhat in giving a soft feel to the leather. The quantity of borax to be used depends upon the condition of the water, but as a general thing one-half of a pound is enough for 100 gallons of water. The borax should be dissolved in a separate vessel with boiling water and poured into the water to be used in coloring.

IMPORTANCE OF CLEANLINESS.

A very important element that is sometimes overlooked is cleanliness. Every vessel in which aniline dyes are dissolved and used should be perfectly clean and free from foreign matter. Sometimes a very small quantity of foreign matter will cause a change in the aniline and affect the shade. When the leather is colored with brushes the latter should be kept clean and a separate brush used for each liquor, one for the mordant and one for the color solution and so on. Too much care cannot be taken in regard to this matter. Many times workmen are careless in their hurry to get through with their work and many defects in colored leather can be traced to this one thing.

SEPARATION OF BLACK AND COLORS.

Light and delicate shades should be kept separate from the dark ones and no black skins nor dyes should be allowed in the same room with the fancy colors. All tables and cloths used by the dyer should be kept clean. Leather tanned in an alum tannage should not be washed long enough to cause a removal of any of the tanning material, which would result in injury to the leather. However, all excess and uncombined tanning material should be removed. Before washing the leather it may be well moistened out with brushes. Skins tanned by the chrome process, upon coming from the tanning liquors, should be thoroughly washed, first in warm borax water and then in clean water for one hour or longer, or until they are entirely neutral to the taste and every trace of the acids removed from them. Much trouble often results when chrome-tanned skins are colored without sufficient washing. The surplus water should be struck or pressed out of the leather and the skins shaved before coloring.

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BLEACHING.

Tanned leather that has acquired a dark color from the tannage requires a bleaching. This is accomplished in various ways. One of the most common methods is to draw the leather several times through a warm solution of sumac or to leave the skins in the liquor for some hours.

Some of the tannins in general use contain quantities of coloring matter, and these exert an influence upon the colors. A great deal of trouble is encountered by dyers in their efforts to overcome this difficulty, especially when the leather is to be colored light shades. Sumac contains very little coloring material and so is frequently used in bleaching leather, and sumac-tanned skins, being light colored, are the most easily colored light shades. In some cases where the color of the leather is dark to begin with, advantage may be taken of this and less dye material used. To tone down the color and to prime the skins picric acid is sometimes used.

Skins tanned in the chrome process intended to be colored light shades may also be bleached by washing them after tanning in warm borax water and then by giving them a hot bath of Sicily sumac. From the sumac bath they are again washed off. This gives the skins a very light color; in fact, when skins are treated in this way and finished without coloring they dry out nearly white. The sumac tends to soften the skins, besides serving as a mordant.

MORDANTS.

In leather dyeing a mordant is any substance whose function it is to prepare the leather to receive the coloring material. The wood dyes formerly used have been superseded by the aniline dyes, as these dyes have a special value for the leather trade, because on most classes of vegetable-tanned skins they are readily absorbed without the use of any mordant.

TONING AND WASHING.

It is very often necessary to tone down the skins and to clear the grain before dyeing. This is accomplished by the use of dilute solutions of acids. Sulphuric acid is often used, but only in very dilute form, as it is very corrosive in nature and a fine-grained skin is often injured by its use. Oxalic acid is also used. The acid is dissolved in water and placed in a drum or vat with the leather and the stock

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is worked in it until all the spots and clouds have disappeared. Leather that is greasy as well as cloudy may be treated with a solution of lactic acid, about one gallon of acid in fifty gallons of water. The usual procedure is to drum or paddle the skins in this liquor for thirty minutes. In this way the grain is opened up a little and cleared of greasy matter, thus enabling the dye to go on evenly.

When the basic or sweet anilines are used it is necessary to wash the skins after the acid treatment before coloring, but when the sour anilines are used no washing is required. In getting some dark shades it is necessary to apply the mordant, then the dye, and to follow with a striker of copperas water. A striker to fix or fasten the color upon the leather may be made by dissolving 2 pounds of bichromate of potash and 1 gallon of lactic acid in 50 gallons of warm water.

The use of this solution gives a fuller, healthier and more even appearance to the colors. This especially applies to vegetable tanned stock. Alum leather may be improved in the same way. The skins may be dipped in the solution or they may be bushed on a table. Before doing this the leather should be uniformly moistened, as the action of the clearing solution will be more uniform.

If acid dyes are used the leather is colored directly after the bath of lactic acid, while for other dyes the acid needs to be washed off before coloring. Sheepskins and some kinds of goatskins are very greasy, and these require a washing in salsoda or borax water. A small quantity of alum may be added to the acid bath for such skins. Sulphuric acid requires careful handling. It should be kept in a glass or porcelain vessel, and mixed with water before using. For clearing purposes a very dilute solution can be used.

Borax is very useful in neutralizing any free acid that may be left in the skins. The dyes will strike a fuller color than they would without the borax. It is also useful in getting rid of any uncombined tannin in the skins. This is important, as free tannin tends to precipitate portions of the dye on the bottom of the vessel. The skins are run through the borax water once or twice before being passed into the dye bath.

DIFFERENT MORDANTS.

Chrome tanned skins are usually mordanted with tannin extracts, from two to three ounces of the same being used for each dozen small skins. Sumac, fustic, gambier and hemlock extracts are generally used. After the skins have been run in the tannin bath they should

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be given a treatment with tartar emetic antimony, by which the grain is cleared of uncombined tannin. When either of these articles is used no potash is needed to set the colors.

Sumac-tanned skins require no mordant, but frequently require a clearing and after the dye has been applied a striking fluid is used.

Combination-tanned skins also usually absorb the dye without a mordant, provided the leather is free from grease.

India-tanned goat and sheep skins may be cleared by the use of borax and salsoda water, the color applied and this followed by a solution of bichromate of potash. In all cases only so much mordanting material should be used as will produce the fixing of the dye upon the leather. When more than this is used the color will be imperfect and the mordant will rub off. For this reason the skins should be washed off after the mordant has been applied, before giving them the color.

When dissolving aniline dyes, care should be taken to dissolve them thoroughly and in such manner that no sediment remains in the vessel. It is well to have the water heated to about 160 degrees, then to add the color and to allow it to go into solution, and the solution should then be boiled for a few minutes. It is a good precaution to strain the solution before using it.

COLORING.

As leather is always colored before finishing, and as the finishing processes sometimes change the shade of the leather, it is very important that the dyer should know just how much color a pack of skins requires in order to have them come through the right shade. On such skins as sheep, goat and calf skins, from two to three ounces of aniline are usually enough for one dozen skins. Various methods may be followed in the process of coloring. The leather may be bushed on tables, dipped into the coloring solution or treated in drums. When the work is done upon tables the workman should so arrange his utensils that they are handy and no time need be wasted. Separate vessels should be used for each liquor. The table should slant away from the workman and should be covered with a piece of zinc or glass. No material should be used as a cover that absorbs the dye material or has an injurious effect upon the leather. In place of brushes, some dyers use large, soft sponges tied to handles.

The skin to be colored is spread on the table, grain side up,

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and struck out with a glass slicker, so that it will lie perfectly smooth and flat without wrinkles. The mordant is applied and well brushed in, then the color solution, and when necessary the striking fluid next. These liquors should be applied evenly over the skin. It is usually necessary to give more than one application of the liquor in order to get the desired shade. After the skin has assumed the right shade, it should be washed with warm water and well struck out. The table should be washed off each time, so that the flesh side of the next skin will not be stained.

When the leather is colored in paddle vats the skins are paddled for twenty or thirty minutes in each of the different liquors, enough of each being used to enable the skins to float and turn in the liquor. More water, of course, is required, and more time consumed by the paddle method than when drums are used. The quantity of coloring materials used per dozen skins is the same in both instances.

When the skins are colored in drums they should first be drummed for fifteen minutes in the clearing or mordanting liquor, and then for the same length of time in the color solution, after which they are washed off and finished.

Colored leather is best dried out in a darkened room. When hung in a strong light the color is liable to fade. The temperature should be maintained at a uniform degree and the leather dried somewhat rapidly, but not so rapidly as to parch or burn it. Skins intended for glove purposes are colored in much the same manner as skins for shoe purposes. They are usually given more fat liquor, in order to get the softness required, and are then finished by rolling or ironing. When a good dull finish is wanted, the leather is ironed while slightly moist, and after drying is rolled again and is then finished.

Many of the dyer's difficulties will be overcome when he understands the various classes of skins, the texture and nature of each, the best materials to use in all instances, and the most practical manner of using such materials. Much of the trouble met with in coloring leather is caused by improper methods employed in the processes over which the dyer has no direct control. Much can be gained by a thorough attention being bestowed upon these processes. All attention thus given will be more than repaid by the improved appearance of the leather.

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BLACKING LEATHER ON GRAIN.

Nine pounds of copperas, ¼ pound of Epsom salts, 6 ounces acetic acid, 1 ounce of powdered nutgalls. Dissolve in 2 gallons of hot soft water, then add 35 to 40 gallons soft water.

Or this: One pound logwood, 2 ounces copperas, 1½ ounces bichromate of potash, 1½ gallons of soft water.

The old-fashioned way: To one pail of tan liquor add a handful of copperas. Stir often until dissolved. Let stand one week before using.

COLORING CHROME-TANNED SKINS.

The finishing of light skins that have been tanned by chrome methods involves a number of processes, the objects of which are to give to the skins the desired color, necessary degree of softness and strength, smooth finish, even thickness, and the smooth and elastic grain surface.

The methods employed in accomplishing these results are considerably different from those by which vegetable-tanned skins are finished.

When the skins are taken from the tanning liquors, no matter whether the one-bath or the two-bath method has been used, they are full of the tanning materials. These must be gotten rid of before success in coloring and finishing can be attained. When tanned by the one-bath method the skins are full of the salts, common and chrome; when the two-bath process has been used they are full of corrosive acids, which, if left in the leather, would cause serious damage to it. The skins are therefore washed thoroughly first for about twenty minutes in a weak solution of borax, using about ½ pound of borax for each 100 pounds of pelt, original weight, and then in clean water for another twenty minutes. This procedure washes out all the salt and tanning liquors and puts the stock in a neutral condition for finishing. After the washing the skins should be thoroughly pressed or struck out on a smooth table with a glass or rubber slicker in order to remove as much of the surplus water as possible. The striking out either by hand or machine also makes the skins smooth, removes wrinkles, and slightly increases their size.

When thoroughly struck out or pressed the skins should be shaved, and during the shaving kept from all stain and grease, as the leather in this condition will absorb stain and grease readily, which

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will afterward interfere with the coloring. By shaving, the skins are made of a uniform thickness and the flesh side is made clean and smooth, which condition is necessary when the leather is to be glazed.

BLUE BACKING.

When the grain side of the skins is to be dyed black it is customary to first color the flesh a blue or purple. This blue backing process not only improves the general appearance of the leather, but also serves as a bottom or foundation color for the black. For this purpose solutions of logwood and salsoda, blue nigrosine and methyl violet anilines are generally used. The use of logwood chips has been greatly superseded during the last few years by the use of logwood in extract or powdered form. The results gotten by the use of these articles are better than the results obtained by the use of the best grade of chips, since the extracts and powders are always uniform in strength and quality. When the paste extract is once frozen the color produced is not at all satisfactory, being a muddy gray-black. The powder, as it cannot be frozen, always gives good results. From 6 to 8 pounds of the logwood paste dissolved in warm water with 1 pound of borax or salsoda and brought to the boiling point gives a liquor of sufficient strength for most purposes. If this should prove too strong it is a very simple matter to decrease the amount of color used.

This solution may be used for blue backing by slightly increasing the amount of salsoda and adding a small quantity of blue or black aniline. When the powdered dye is used about 5 pounds of the dye and 2 pounds of borax or salsoda boiled a few minutes in 50 gallons of water, gives a very satisfactory liquor. This may be also used for blue backing.

When used for this purpose the skins should be run in the drum until the color is well taken up and developed, and then spread on a table and a striker of iron liquor applied to the grain. This gives a blue flesh and a black grain. Or the skins may be passed through the striker in dye boxes or run through a machine. The method of getting a blue flesh with nigrosine is as follows: For each dozen skins, medium size, from 2 to 3 ounces of the nigrosine is boiled for a few minutes in sufficient water. This is added to the skins in the drum at a temperature of 120 degrees, and the skins drummed in this for from twenty to thirty minutes, or until the color is well taken up,

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Unless the leather has been thoroughly washed after tanning, the blue color will not penetrate as it should. The water is next drained off, the leather pressed or struck out, when it is ready for fatliquoring.

LOGWOOD AND IRON.

When logwood is used, a black on the grain is obtained by the use of an iron liquor or striker. A good striker may be made as follows: Dissolve 4½ pounds of copperas and 1½ pounds of blue vitriol in a half barrel of water. Boil until dissolved. Fill the barrel to a total of 50 gallons of water. In using on a machine dissolve 12 pounds of copperas and 4 pounds of blue vitriol for each barrel of water. To this add 1½ pounds of ground nutgalls and 1 pound of Epsom salts to each 6 pounds of copperas and blue vitriol combined. When coloring on a table add a small quantity of ammonia to each bucket of the dye, spread the skins upon the table and slick it out. Apply the dye and brush it well into the leather, then apply the striker. Strike the skin out again, apply another coat of the dye and follow this with more striker. Brush the skin thoroughly, wash off in warm water, and strike out. When this method is used the leather should be first fatliquored and then dyed.

The skins may also be blacked by drumming on a machine, by brushing as above described, or they may be folded and dyed in dye boxes or trays, as follows: Fold the skins through the center and with a glass slicker smooth them out so that no blacking can reach the blue flesh and mar its appearance. Fill a dye box about two-thirds full of dye liquor and another box about two-thirds full of iron liquor or striker, using the latter in a weak solution. Dip each skin singly into the dye liquor and then into the striker. Wash off the skins, strike them out and proceed to finish them. A few fustic chips boiled with the dye intensifies the black.

FANCY COLORS.

In the production of fancy shades of color upon chrome-tanned skins it is necessary that the grain be as light colored as possible and free from grease. Practical experience has taught that before a chrome-tanned skin can be colored with aniline dyes it must be first treated with some substance containing tannin. Sumac and fustic are generally used, usually in the extract form. The amount of coloring matter in sumac is very small, and for this reason it is gener-

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ally used for light colors. For dark shades other articles are used, and by taking advantage of the coloring matter contained in them a saving in the amount of dyestuff may be effected. For some medium dark shades a fustic liquor may be used as a mordant; for dark shades a mixture of fustic and logwood. Only such a quantity of mordant should be used as will produce the fixing of the dye upon the leather. When more than this is used the color will be imperfect and the mordanting material will rub off. The dye should be thoroughly dissolved and no sediment be allowed to remain in the vessel. It is well to have water heated to a temperature of about 160 degrees, then to add the color and allow it to go into solution, after which the solution should be boiled for a few minutes.

For medium and small skins about 5 ounces per dozen of liquid extract of fustic, or a solution of about 4 ounces of extract of sumac, used at a temperature of 100 degrees, give good results as mordants. The skins require to be drummed in this for fifteen or twenty minutes. Then to the same bath is added 2 ounces per dozen of tartar emetic or of antimonine, and the skins drummed for fifteen or twenty minutes longer, when they will be ready for the color bath.

As the leather is always colored before being finished, and as the dying out and working of the leather ofttimes changes the color of the leather, it is very important that the dyer knows just how much color to give a lot of skins in order to have them come out the desired shade. The skins may be colored on tables with brushes, in paddle vats or in drums. The last method gives the more uniform results. The color should be given to the skins in portions, and one portion should be well taken up before another one is added.

OXBLOOD COLOR.

Oxblood is a very popular shade, and a good color can be obtained by the use of the aniline amaranth 3R in the following manner: For each dozen skins use about 4 ounces extract of sumac. Drum the skins in this for about fifteen minutes, in sufficient water at a temperature of 110 degrees. Then add to the same bath 2 ounces for each dozen skins, tartar emetic or antimonine and drum for twenty minutes longer. If the skins are sheepskins the dry powdered sumac may be used in place of the extract. The skins are next washed off in warm water and the color bath prepared at a temperature of 120 degrees. From two to three ounces of the aniline are used for each dozen skins and the

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skins are drummed for twenty minutes. Then the leather is washed off and fatliquored. The shade can be darkened by using 2½ ounces of amaranth 1R in place of the amaranth 3R, combined with 1 ounce chocolate brown for each dozen skins. The temperature of the drum should never be allowed to fall lower than 100 degrees during the coloring operation; neither should the drum be stopped until the color has been in for at least ten minutes. Chrome-tanned sheep, goat or calf skins may be colored a very nice shade of chocolate in the following manner: Use from 2 to 3 ounces of the aniline chocolate brown 270, according to the size of the skins. First mordant the skins in a drum for twenty minutes by using 5 ounces per dozen liquid extract of fustic at a temperature of 120 degrees. Then add 2 ounces per dozen of tartar emetic or antimonine, by which the grain is cleared and the aniline fastened upon the skin. Run the skins in this for twenty minutes longer. Then prepare and add the color bath at a temperature of 120 degrees. Drum for twenty minutes, wash off and fatliquor.

Another very popular shade of brown can be obtained upon the skins by being drummed in a fustic solution as above described and after being cleared, by the application of 3 ounces of leather brown F.

CHOCOLATE SHADE.

Another method of getting a chocolate shade upon chrome-tanned skins is as follows: For one dozen skins run for fifteen minutes in 5 ounces of liquid extract of fustic; then add 2 ounces of either tartar emetic or antimonine and drum fifteen minutes longer. Then run off this bath and add water for a new one at a temperature of 120 degrees. Dissolve the following colors and add them to the skins: Four ounces of phosphine for leather; ¼ of an ounce of leather green M; ½ ounce of methyl violet 2B. Drum the skins in these for twenty minutes and then add ½ ounce bichromate of potash and run for five minutes more. Particular care must be taken that the anilines are thoroughly dissolved before they are added. To insure even colors, either add the dye through the hollow gudgeon of the wheel or throw the skins to one side and put the color liquor through the door. After coloring wash the leather off in warm water, strike it out on the flesh side and then on the grain side, fatliquor, oil grain lightly with neatsfoot oil, and dry the skins out. If the skins are sheepskins, they may be fatliquored by using 1 pint of egg yolk and ½ pint olive oil for each dozen skins, ap-

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plied immediately after coloring, and the skins drummed in it for twenty minutes.

The solidity and firmness of light skins may be somewhat increased by washing the skins after they come from the tanning bath in a solution of whiting and salt, using about 10 pounds of salt and 5 pounds of whiting in 50 gallons of water. The skins should be drummed in this for one-half hour, then washed in clean water until the whiting has been entirely washed off, then the leather may be shaved and colored.

In chrome-tanned pickled sheepskins the best method of getting a dark ox-blood shade is by first mordanting the skins in a drum with a mixture of fustic and peachwood extracts, used at a temperature of 120 degrees. About 1 pound of the fustic and 2 pounds of the peachwood extract should be dissolved in boiling water, and of this liquor about 15 gallons should be used for each dozen skins. The skins should be drummed in this for one-half hour. Then dissolve and add 6 ounces of amaranth 3R and ⅛ of an ounce of malachite green in one gallon of hot water. Then add 1 ounce bichromate of potash and drum the skins for thirty minutes. Sheepskins intended for glove leather can be very satisfactorily colored by the use of any of the formulas given here, and when the directions are carefully carried out the shades will be full and clear. Good judgment must be exercised by the dyer and the leather must be free from grease and thoroughly tanned; also the dyes must be carefully prepared for use.

When the skins are shaved before coloring a saving in the amount of dyestuffs necessary can be effected. Yellow glove leather from sheepskins can be produced by the use of any of the various shades on the market for the purpose. Sumac or fustic are generally required as mordants for these.

HOW TO FINISH OIL AND BOOT GRAIN.

After the leather is split and tanned, scour it well, especially on the grain side; dry it thoroughly. Then damp the sides evenly, for mill stuffing, having just enough dampness in the stock so as not to be able to squeeze any water out of it.

Let lie over night, then stuff. Take 65 pounds degras, 36 pounds paraffine wax, 30 pounds pure tallow. Heat the wheel to 135 degrees. Have the stuffing at 120 degrees. Use 35 pounds of stuffing to every 100 pounds of leather, damp weight. Let run 25 to 30 minutes.

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Hang up for a short time to chill before setting, then set tightly on both sides, and dry out. After they are dried thoroughly the grain should be buffed over lightly, which will hide grain scratches and other little imperfections. Then black with strong logwood and a good grain black.

BLACKING.

The following is a good black for grain leather: Take a common barrel, and put in it six pails soft water and 13 pounds of copperas. Boil until it is dissolved, add 2 ounces prussiate of potash, 2 ounces indigo blue, 1 pound tincture of iron, and boil all together and fill the barrel with water; stir when cool. After blacking dry them out and then smut the sides with brush wheel or by hand brush.

Then give a light coat of bottom finish, which can be made by mixing one gallon of levant ink with one quart of common flour paste. After the paste is dried in, oil lightly with paraffine oil. After the oil is in the leather damp the sides on the flesh side, and let lie in a pile covered over night. Then print and dry them out before graining. Grain them four ways on the grain side, and one way on the flesh side.

WATERPROOF DRESSING.

After they are grained give them the dressing to make them waterproof. Use two quarts linseed oil and two quarts paraffine oil, one-quarter pound burgundy pitch, one-quarter pound beeswax. Heat all together and put on the grain side, hot. Even with a swab. Then let them hang in a warm room until all is in. Then put on the last coat of finish, which is made by dissolving 8 ounces of extract of logwood, 1 ounce of bichromate of potash, 2 ounces of prussiate of potash in 2 gallons of soft water. When cool strain, and to each gallon of liquid add two quarts of beef blood. Spread one coat with sponge evenly on the grain and the leather will be a nice deep black, with a clean, lustrous appearance that will suit any market.

DULL FINISH FOR SEAL GRAIN.

Soak 2 pounds of gum tragacanth over night in 1 quart of cod oil. Next morning add 4 gallons of water, which should be boiling hot. Do not cook in this hot water, but simply put it on the gum. The following morning add 4 gallons more of hot water and leave it stand

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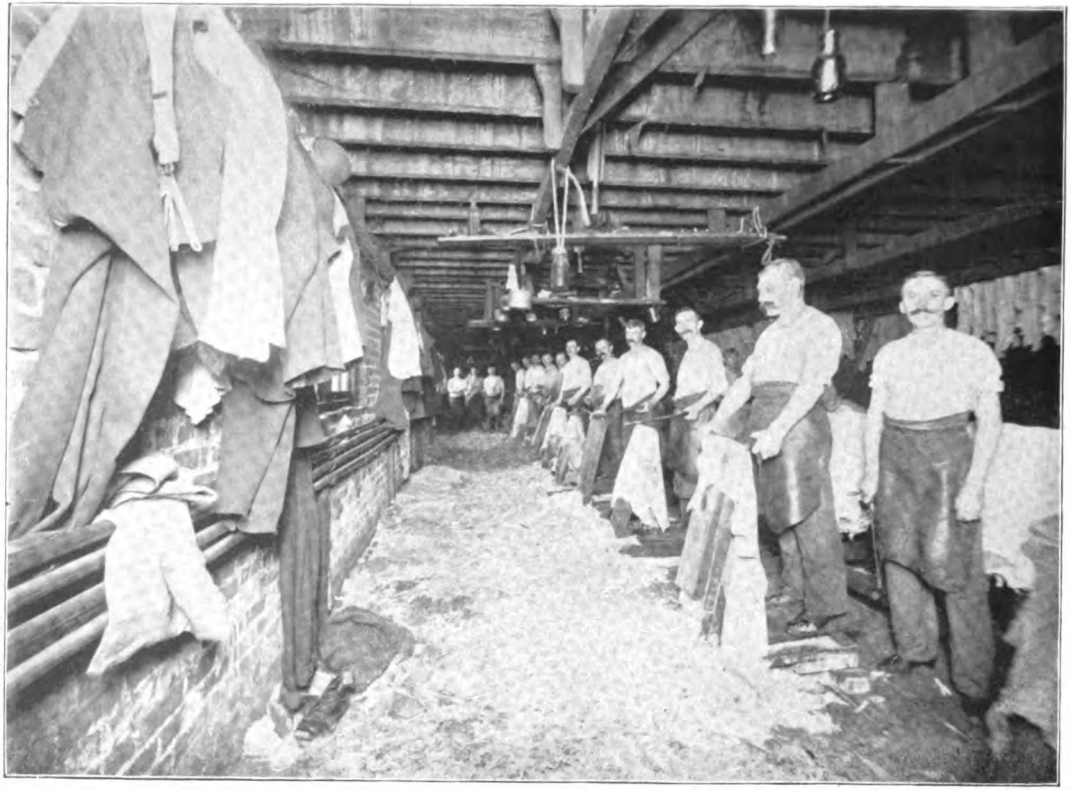

HAND SHAVING.

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over night. Stir it occasionally every few hours, so that the oil will unite with the gum.

Now add 2 pounds of glue and 1 pound of nigrosine B., which should have been dissolved in 2 gallons of water. Now add this mixture together and you will have 11 gallons of material. It might be well to cook the glue alone first before adding it to the gum. Some people also cook the nigrosine by itself. If the stuff is not well cut the leather is liable to have a sandy feel.

Use ½ pint of glycerine to every 2 gallons of finish. No ammonia or soda is necessary. The finish should be applied in a warm room—80 degrees—by one man with a sponge. It should be well rubbed in. Use more glycerine if the leather is inclined to spew.

If a brighter finish is needed add a few ounces of albumen to every 3 gallons, but do not cook. Orange shellac can be employed in place of the albumen. This you can keep hot if needed.

FINISHING CHROME AND RUSSIA LEATHER.

To color leather blue or purple on the flesh side before it is dyed black on the grain gives it a distinctive appearance and helps in getting a good color upon the grain. Upon calf, goat, sheep and kangaroo skins the following methods of flesh coloring have been found to be of great value. When the skins come from the tanning liquors wash them thoroughly, press them or strike them out and shave them in the usual manner.

MORDANTING.

Then prepare a mordanting liquor by using for 3,000 pounds of leather, weighed after shaving, 3 gallons of palmetto extract and 1 pint of glycerine in water at a temperature of 85 or 90 degrees. Drum the skins in this liquor for twenty minutes, then dye the flesh with either purple aniline, blue nigrosine, or a solution of logwood and salsoda or borax.

PURPLE ANILINE.

When purple aniline is used about 3 ounces may be used for each dozen skins, and prepared for use by boiling in 2 gallons of water. Drum the skins in this liquor for twenty minutes, then press them and pass them, folded grain side out, through logwood and striker, wash them off and apply to the grain a fast black aniline, strike out skins and proceed to finish in the usual way.

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BLUE NIGROSINE.

When blue nigrosine is used, use 3 ounces for each dozen skins, and apply in the same manner as above. When powdered logwood is used about 1 pound of the same, with 2 or 3 ounces of borax or salsoda, boiled in ten gallons of water and used at a temperature of 120 degrees, produce good results.

FAT LIQUOR.

After staining the leather may be fatliquored and grain blacked. The use of the tanning extract serves as a mordant and thereby improves the color, and also makes the grain more solid and less liable to peel. Gambier may be used in the same manner, but it costs more than palmetto. The latter article is somewhat new to tanners, but its good qualities are being fast found out.

Russia calf, side leather and combination tanned stock may be treated in the coloring operations in the manner suggested for chrome leather. It may not be necessary to use the palmetto extract on this class of stock, but the coloring directions work well and help to deepen the color of the grain.

RETANNING.

A retanning in sumac is usually considered a benefit to such leather previous to coloring, the skins being moistened and washed and then drummed in sumac liquor for twenty minutes, before they are colored upon the flesh. After the grain has been blacked with logwood and striker the color may be improved by the application of fast black aniline dye. No grey bottom ever results when the skins are treated in this manner.

RECIPE FOR FAT LIQUOR.

A very good fat liquor is made as follows: In a half barrel of water dissolve by boiling and stirring 25 pounds of potash soft soap, then add 50 pounds of English sod oil and 1½ gallons of any other good leather oil. Mix the oil and soap thoroughly together and add water to make a total of 50 gallons of fat liquor. When the skins are taken from the tan press them well to get rid of surplus liquor, or let them drain for forty-eight hours. Heat a stuffing drum well with hot air or steam and add 1 gallon of oil for each 150 pounds of stock, weighed after being drained or pressed. Drum the skins in the oil until it is well taken up, then dry the leather out. After drying weigh the stock and moisten it in a tub of warm water and let it lie in pile for

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twenty-four hours until it becomes uniformly soft and moist. This may also be done in a drum. Then shave the skins and get a uniform thickness and smooth, clean flesh. Put them in a drum and run with just enough water to moisten all parts alike. Drain off water in the drum. Have temperature of the drum about 110 Fahr., and use 20 gallons of fat liquor for each 100 pounds of leather weighed in the dry condition. Some tannages will get along with less than this quantity of fat liquor. It is seldom that more is required. Drum the leather in the fat liquor until the grease is all taken up, then hang it up and dry it out again, then moisten back and color. All excess of moisture in the drum should be guarded against during fatliquoring, as it retards the proper absorption of the fat liquor.

COLORING.

To prepare the stock for coloring after drying out, dampen the leather in a tub and place in piles for twenty-four hours to soften. Then proceed to color as has been already described.

Another method is carried out by the use of sumac. Take one-half pail of sumac and scald it for two hours in a closed vessel. When ready for use add 4 pails of water and 1 gallon of lactracine to the prepared sumac, and use this quantity of liquor for 90 calfskins of average size, or 60 medium sides. The liquor should be warm, at a temperature of 100 degrees, and the stock drummed in it for thirty minutes, then add the blue backing liquor, drum twenty minutes longer, remove leather from drum and black the grain, strike it out well and oil lightly and dry and finish the leather in the usual way.

The drumming of the leather in the sumac liquor also prepares it for yellow back. A good fat liquor is made also of 5 pounds of soap, 1 gallon and 1 pint of moellon degras in 25 gallons of water, steamed to 120 degrees F. This quantity of fat liquor will answer for 440 pounds of pressed leather, which should be drummed in the liquor for thirty minutes. Then the door of the drum is opened and the skins washed in water for ten minutes. The leather is next struck out and hung up and dried, then sorted for the various finishes.

LOGWOOD AND LOGWOOD EXTRACT.

The amount of coloring matter in logwood greatly varies, absolutely dry chips containing from 4 to 9 per cent. coloring matter. A sample of Laguna chips contained 4½ per cent. coloring substance,

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while another wood showed 9 per cent., the wood containing 4½ per cent. being therefore worth only one-half the price of the 9½ per cent. logwood.

In Europe the extract factories, as a rule, boil out their logwood chips in open copper kettles, about the same as tanners are accustomed to do in this country. In the United States, extract manufacturers leach their logwood in closed digestors, under steam pressure. The high temperature usually employed by American extract makers destroys a certain portion of the coloring matter, while in the European method this is not the case. On the other hand, American manufacturers obtain about 20 per cent. more extract out of a certain amount of wood than the European extract men. This 20 per cent. more consists of extractive matter, dissolved fiber, etc., but contains hardly any coloring matter. Owing to this radical difference in the manufacture of logwood extract, the results obtained with the American extract are unlike those derived from the French and German product.

Take for example the use of logwood extract to black leather. We find that leather blacked with American extract smuts much more than that dyed with the better grades of French extract, and the shade obtained by the American extract is more of a dirty grey-black, while the French extract produces a clear blue-black.

There are very few extracts to be had that are not adulterated, and the price generally is adapted to the degree of adulteration. This explains why logwood extract can be bought at almost any price from 4 cents to 15 cents per pound. The poorer grades of French extract often contain 50 per cent. and more adulteration, or one-half of the entire extract is made up of foreign substances, such as glucose, hemlock extract, dextrin, etc.

Logwood extract made with high steam pressure often contains so much fibrous and resinous matter that the solution of such extract in water will be half sediment. With such extract it is of course impossible to obtain good results.

Tanners are generally prejudiced against logwood extract, owing to their experience with these poor grades, although it is beyond doubt that excellent results can be obtained with logwood extract for blacking leather. But there exists about the same relation in the economy of using logwood extract against the logwood chips as there is between hemlock extract and hemlock bark.

If the tanner leaches his logwood properly and manages to get the

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strength out in the form of serviceable liquor without destroying any coloring matter, chips are decidedly cheaper than extract.

The manufacture of logwood extract is a queer industry. Instead of making the extract where the tree grows, in the West Indies and Central America, the wood is shipped to the United States and Europe and there made into extract. From Europe this extract is again largely shipped back to America.

MANUFACTURE OF COLORED LEATHER.

Look after your beamhouse. This is of much importance. If stock is not properly handled in the limes, results are unsatisfactory.

For bag and pocket book leather, commonly known as the Levant kinds, high-limed leather is preferable. For strap and shoe leather low liming is better.

Lime is an enemy to leather, therefore hides and skins should be thoroughly worked out before being sent to the liquors. Foremen cannot be too particular in paying special attention to demanding clear stock from their men. Carelessness in the beamhouse is always a possible and costly danger, which can be easily avoided by proper supervision.

Hemlock tannage, followed by gambier, is good for colored leather.

When the stock has been in the handlers for a week or ten days it is sent to the press and made ready for splitting, which is a delicate operation, great care being necessary to get a uniform substance.

For retanning, quebracho and gambier, or sumac and quebracho, are used at a strength of about 12 to 14 degrees barkometer.

After being thoroughly tanned the leather should be put in a drum, and there cleared or washed by a mixture of borax and lukewarm water. The wheeling should occupy about fifteen minutes. The wheel should then be run off, and a mixture of lukewarm water and oil of vitriol or sulphuric acid put in the wheel, enough being needed to float the leather in the drug. After five minutes' motion, add lukewarm water and wash free from acid, and it is then ready for the sumac.

Take about two pailfuls of dry sumac and add enough water to scald it. Then put in enough cold water to reduce the temperature to 90 degrees. Put the sumac in the drum with the leather and wheel for forty minutes; then remove and wash the leather, which may now be sammied and set out for table coloring or dyed by immersion.

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Much depends on the judgment of the workman, who should have a thorough knowledge of the properties of borax and acid.

These are just a few thoughts in regard to leather making, but possibly they may give a point or two of interest.

RECIPE FOR PASTE.

Here is a good paste for calf and upper leather:

Two pounds flour, 1 pound tallow, 1 pound frozen glue, ½ pound white wax, ½ pint English sod oil, ½ pound hard soap, 11 ounces dextrin.

Soak the dextrin and glue over night. Mix flour, paste and oils, using about 2 gallons of water with the flour. Boil ten or twelve minutes, then add the dextrin and glue. Add soap when cooked. Stir constantly while cooking. Apply when cold.

Should the leather be very coarse or open, increase the quantity of flour and glue. The man in charge of the finishing should understand this point and alter his finish to suit his stock. We would suggest using two pounds French talc to every pail of blacking. Stir thoroughly and occasionally while using the black. French talc may be obtained at any drug store, and gives a most desirable, silky feeling after finishing and helps to fill the coarseness of the stock. Few leather manufacturers are aware of the good qualities resulting from using talc.

FINISH FOR CALF AND OTHER LEATHER.

Soak one-half pound of frozen glue until thoroughly soft. Boil with a little palm oil and mix with the pan of gum tragacanth.

GLOSSES FOR LEATHER WORKERS.

The term gloss is applied by workers in leather to a preparation that puts a finishing touch to the surface of the work, and is synonymous with the term "varnish," used by the woodworker, or "lacquer," the latter adopted by workers in metal. Expert workmen are very reserved about the components and methods of preparing special compounds wherewith they finish their work—and not unnaturally so, as what knowledge they have gained by much laborious experience and countless experiments deserves to be jealously guarded from the prying eyes of fellow workmen.

In preparing finishing glosses for various kinds of leather it is not

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alone necessary to know what materials to use, but the actual method of compounding, combining or mixing the ingredients is the chief thing to master. My readers might feel inclined to wager one that paraffine oil will not combine with water, but it can be made to do so very easily and in a way that leaves no trace whatever of the paraffine. So, likewise wax and water, oils and water, and many other very dissimilar substances can be combined one with the other by persons possessed of the secret how to cause such combination. A chemical analysis may reveal the components of a compound and likewise the exact proportions of each one, but such analysis does not explain *how* those components have been caused to combine, and, no matter how clever the analyst may be in ascertaining the ingredients of a compound, yet such analysis is practically useless to him in building up a similar compound, should he wish to do so, unless he be skilled in synthetical chemistry or has a wide experience in preparing compounds in which these several ingredients are used. For example, a very popular leather dressing consists of shellac, gum arabic, water and birch oil, but, given these ingredients, how are you going to make a hard, brittle body like shellac dissolve in water so that no trace whatever of it can be discovered, or make such dissimilar bodies as shellac, gum and oil combine to a homogeneous compound?

Again, another most important point in compounding glosses is the relative quantity of each ingredient, for, unless you be exact on this point, the compound when prepared may dry too quickly or not dry at all; it may be dull when it is wanted brilliant, or *vice versa;* it may be too thick instead of being fluid, and in fact be totally unlike the article actually required. Now, if the operator is familiar with the physical and chemical qualities of the several ingredients of which the compound is prepared he may, after more or less experiments, be able to compound a preparation suited to his needs, as a little more of one ingredient or a smaller quantity than that prescribed of another may set matters right, but such research entails great labor, and consequently time, which perhaps the operator cannot well spare. But a few such experiments are good for him, as it causes the operator to justly value a recipe or formula, no matter how simple it may look when written out on paper. Take, for example, the formulæ given below, which appear very simple and devoid of all mystery, and therefore are likely to be held in light esteem by the unthinking; they are none the less skillful chemical combinations—the outcome of many and many

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experiments, before the precise relative quantities and the several ingredients could be definitely stated so as to always insure similar results. From this fact alone the formulæ are worth respect, but, when the operator finds after one or two trials he is able to make the desired compound easily and simply, and that it gives every result desired, he should not deny a small tribute of respect for the patient, laborious research which has been expended in bringing such formula to perfection, and, moreover, he should prize highly the recipe when once he has obtained a mastery over the manipulatory process in compounding same. He is then possessed of knowledge which will be his for his lifetime. The formulæ given below are the practical outcome of skilled research and have been proved by actual experience to produce all that is claimed for them.

FORMULA FOR JAPAN OR VARNISH.

A cheap japan or varnish is made as follows, but is not very flexible: Ingredients—

1½ lb. black pitch.
70 fluid ozs. benzole (benzine).
8 oz. turpentine.

METHOD OF PREPARATION.

Dissolve the pitch in the benzine, and then add the turpentine; the last material gives a slight amount of flexibility to the lacquer, but it is only suitable for such articles as do not bear much pressure. For flexibility, japans or enamel, Venetian turpentine or glycerine are the best ingredients to use.

FLEXIBLE VARNISH FOR HARNESS LEATHER.

The following recipe gives a cheap flexible oil varnish suitable for leather that has to be handled and bent: Ingredients—

1 gallon linseed oil.
½ lb. burnt umber.
¼ lb. asphaltum.

METHOD OF PREPARATION.

Put the asphaltum and a little of the oil into a copper vessel and dissolve by heating over a hot plate or other suitable source of heat; then separately grind up the umber in some of the oil; mix this with the asphaltum, and finally thin down by adding the remainder of the

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oil; boil up from half to one hour, and then allow it to cool slowly, and when cool thin with cold turpentine to the required consistency.

GLOSS FOR GLACE AND SHEEP LEATHERS.

The following process is adopted by a German firm: For black strapleather the black color is produced by staining with Sand's black, and then a finish is put on composed of bullocks' blood, logwood, liquid ammonia, a little of Sand's black and a little milk; this gives a rich, deep finish which can be glazed by means of the glazing stone.

For glace leather a good sumacking and slicking out very tight is first of all given to the leather, and then a black color is produced by the application of Salzburger vitriol (also called eagle vitriol)—it is a mixture of sulphate of copper and sulphate of iron, and sometimes a mixture of sulphate of copper and sulphate of zinc, the latter compound being chiefly used in dyed glove leather.

To remove any grease from the hides they should be brushed over with stale urine before applying the stain, and bring up to dry a little; then stain with a solution of the above compound and again bring up to dry, and repeat this process until a deep black is obtained, never allowing the hides to become quite dry before again applying the staining solution. Should the urine not eradicate sufficiently all traces of grease in the leather a leveler composed of a mucilage not too thick, made of boiling linseed in water and strained, should be brushed or sponged over the leather before applying the above staining fluid, but the writer would recommend as an improvement on the above process the use of strong liquid ammonia, instead of the disgusting and obsolete practice of using urine; it is only custom which recommends the employment of such a fluid, by reason of a certain amount of ammonia which is in its composition, and therefore the direct use of ammonia would be much better.

As a finish to the stained leather, either the linseed mucilage can be used or that already mentioned composed of blood and ammonia, etc. The writer, however, finds that the following compound gives a most superior finish to leather that is to be glazed under the wheel: Curdle good, new milk by standing it in a warm place for a few hours; then filter or strain off the curds, and wash them repeatedly with hot water until the wash water shows no further trace of acidity; then collect the curd and dissolve it in liquid ammonia to a suitable consistency—about that of milk—and sponge the dyed leather once

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or twice with this gloss, and when dry a splendid glazed surface is obtained. This finish is excellent for colored leathers.

GLOSS FOR BOOKBINDERS' LEATHER.

Gloss for skivers and bookbinders' leathers is as follows: Ingredients—

3 pints methylated spirit (not methylated with naphtha).
½ lb. elemi resin.
½ lb. mastic.
¾ lb. sandarac.
6 oz. Venice turpentine.

METHOD OF PREPARATION.

Put the spirit into a large glass bottle or stoneware jar; then put in the resin, tie a piece of bladder over the mouth of the vessel and prick holes in it so as to permit the vaporized spirit to escape—if a cork be put in the neck of the bottle it will be blown out, and some of the contents will also be very likely to spurt out; now stand the bottle on the hob of an ordinary fire grate or in a vessel of nearly boiling water and frequently shake up the contents. By this means the resin will be quickly dissolved in the spirit; when they are all thoroughly dissolved in the fluid, allow it to settle for a few days and then pour off the clear portion for use, without disturbing the sediment. Keep this gloss in tightly corked or stoppered bottles, as, if loose corked, the spirit will evaporate and the varnish thus be rendered thicker and perhaps too stiff for use; although it may be thinned by the addition of more methylated spirit, yet the product will not be so good as that originally made. To color this gloss steep a few grains of a suitable aniline dye in the spirits before putting in the solid ingredients, or else use tinctures of the dyewoods (as logwood, or dragon's blood). If the corks or stoppers of varnish bottles be dipped in melted paraffine wax before corking up the varnish will not stick or adhere to the neck of the vessel, and will thus be easily removed.

SIMPLE GLOSS.

A simpler compound of gloss for a similar purpose is made by dissolving

3 oz. sandarac resin in
1 pint methylated spirit,

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and allowing the varnish to clarify by standing. This gloss is a very slow drier, and can be made thicker or otherwise by varying the proportions of above ingredients. It can be colored as indicated in recipe above.

TRANSPARENT BROWN VARNISH.

A transparent brown varnish may be obtained by dissolving shellac in water and boiling it with borax or carbonate of soda in the proportions of 4 oz. shellac and 2 oz. borax per gallon of water, and at the same time coloring with a suitable aniline dye, as Bismarck brown.

WATERPROOF DRESSING.

The ingredients are as follows:

1 lb. mutton suet (freed from all skin and membrane).
1 lb. beeswax.
1 oz. resin.
1 quart linseed oil.

METHOD OF PREPARATION.

Put all these ingredients into a suitable sized boiling pot and boil together until the mass is homogeneous in consistency. To use this dressing lay it on the leather just warmed up by means of a brush.

GOLD GLOSS.

The ingredients for a gold colored gloss are as follows:

10 oz. oil of turpentine.
5 oz. Venice turpentine.
5 lbs. seed lac.
5 lbs. sandarac resin.
3¼ lbs. gamboge.

METHOD OF PREPARATION.

Powder the gamboge and steep it in the turpentine, also mix the seed lac and sandarac resin with the Venice turpentine; then, when the gamboge is dissolved, mix the two compounds, put into a wide-mouth jar, cover over with paper to prevent vapor getting into the mixture; then stand the jar in a vessel of boiling water until the whole of the solid components are dissolved and a uniform consistency results. As turpentine instead of spirits is the liquefying agent, aniline colors will not color this compound; therefore recourse must be had to the dyewoods for coloring the gloss.

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Light Leathers.

ECONOMICAL TANNING.

FINISHED OAK, CALF AND KIP.

The first question I would ask the "small tanner" is, Can you sell finished oak calf and kip skins direct to the factory? If so, give your skins a thorough soaking for twenty-four hours, changing the water at least twice in that time. Protracted soaking of hides and skins in water loaded with salt and other impurities will not accomplish the desired result. Give your skins a rather heavy working on flesh side over the tanners' beam with worker edge of knife made sharp enough to tear, not cut, any lumps of flesh off. Put in clean water for twelve hours longer, then put skins into limes, fresh ones preferred, made strong enough to swell the skins in twenty-four hours. Reel or stir in limes at least twice daily, and lime until with thumb and finger you can push hair off freely. Put into warm water and unhair thoroughly, taking care to get all fine hair out at first working. Put skins into fresh, clean water as rapidly as they are unhaired, then flesh, using the back or worker edge of flesher almost entirely. By so doing you get a cleaner skin into the bate and avoid dangers of cutting the skins.

BATING.

Now comes the bate question. The writer uses hen manure entirely, finding its use simplest, cheapest and most satisfactory. I use three pecks clean droppings to vat of 900 gallons water, enough for 100 skins of 10 to 14 pounds each. Put manure into a tub at least three days before using. Fill tub with water and let stand till it works over the edge of tub; it is then ready for use. Heat the bate milk-warm and stir skins every three hours during the day. When the impress of thumb and finger can be plainly left on butt of skin the bating has been accomplished. Give skins a good working out of bate on grain side, using good bolster on beam. Put into clean, cool water, give a thorough washing and your skins are ready to tan.

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HANDLING.

I would use rocker handler in preference to any other. The frame should be 4½ feet wide and as long as your vat will admit. Use sticks ¾x3 inches; also brass nails so spaced that you catch the tail and each hind shank of skins, putting two skins flesh to flesh on each stick. Use a liquor so weak at first that your skins will take on a straw color the first twenty-four hours, increase the strength daily so slowly that the grain keeps mellow. The skins should be entirely struck through in thirty days. Take out of racks and shave the entire skin. Put in a liquor not as strong as one they came out of. Stir frequently. If the work has been properly done, the skins should be very plump, and if handler liquor gets the least sour they will be somewhat stiff. Do not worry over that. Now give a pretty good liquor, say, 10 to 12 degrees, using a liberal supply of finely ground bark in laying away. If skins are stiff use more bark than when not. Leave lie twenty-four to thirty days, when they are ready for currying.

Slick off the flesh side. Scour the grain well. using a fine grained stone; hang up in dark place to sammy. Set out well, using fine grained stone on grain and put enough stuff on flesh to get skin to stick to table.

STUFFING.

For hand stuffing use good tallow and cod oil, equal weight of each. Melt tallow slowly, put into tub, and when almost cool, add the oil; stir well. If the tallow is scorched or was too hot when oil was added, the stuff will be granulated and not spread smoothly.

Having oiled the grain side of skins, when set out they are ready for stuffing. Use 150 pounds stuffing to 400 of dry leather, or about that proportion. Hang up by hind shanks, so skin will hang flat when nearly dry; take down and reset the grain, damping any dry spots with warm water. Hang up again and dry thoroughly.

WHITENING.

Now white the skins, using slicker in preference and board well, so as to loosen the fiber of skin. For blacking, I prefer a soft soap made by dissolving some castile or other fine hard soap in warm water, adding 1 pound fine lampblack to 3 gallons soft soap, which should be a pretty thick paste.

Pile the skins, flesh up, on table in one pile, but not one skin precisely over the other. Allow every skin to overlap right and left about

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one-third of its width. This gives firmness to pile, and prevents slipping. Apply black with a round brush and hang skins grain to grain on a trestle as they are blacked. When blacked, brush off any surplus blacking on skin and go over flesh side with glass.

PASTE.

They are now ready for paste. I prefer a starch or flour paste. Stir 1 pound of starch, or 2 of flour, in enough cold water to wet thoroughly, leaving no dry lumps. Have 3 gallons hot water near boiling point. Put starch or flour into it, boil and stir constantly to prevent settling. When thoroughly cooked add 6 pounds hard tallow to the paste and stir in well. When cool, should be thicker than cream. Apply paste to skins with a soft-haired brush and glass lightly when dry.

They are now ready for final finish.

FINISHING.

Soak two pounds white glue in half a gallon of water. When soaked, dissolve over a slow fire and add one gallon cold water. Put aside to cool when set. Add 1 quart of sweet oil and 1 pint alcohol, stir thoroughly, as the whole mass should be an emulsion of cream-like appearance and consistency.

Apply a slight coat with a soft, clean sponge. The work must be done rapidly and finish applied evenly, or skins will be streaked when dry. If all the work has been done well, you will have skins of plump, mellow grain and fine smooth finish, dry but not harsh, that will bear handling well without showing any injury from same; leather that will be fine-grained, good color and bright, that should sell well in any market, at highest prices.

THE MANUFACTURE OF LEATHER LINING.

Great care is necessary in the manufacture of leather lining, an article which is in good demand in the shoe trade. Many of those who claim to make a specialty of it fail to give it the amount of attention which is required in its production.

Slunks and deacons are used in the better grades of lining, and when tanned and properly colored find ready sale.

A good process is to soak thoroughly in cold water the skins selected for lining. Then flesh by hand, being careful not to break the grain.

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In liming, start with a rather weak solution—say 75 pounds of lime to 200 gallons of water. Handle the skins every day for six days and strengthen the solution according to the condition of the stock. The skins should then be unhaired and fleshed again.

It is very essential that in refleshing the beam hand should have fresh water ready, in which to immerse the skins, as the tender nature of the stock will not at that stage stand exposure to air, and is apt to spot. This would give the finished leather a cloudy appearance.

When the skins are thoroughly free from lime place them in the bate. A bran bate, it may be added, is the most desirable. Leave the skins in the bate five or six hours, then wash well and pickle.

RECIPE FOR PICKLING.

A good pickle is made of 150 pounds of salt and 50 pounds of oil of vitriol dissolved in 200 gallons of water. While in the process of pickling the skins should be kept in motion and taken out at the expiration of six hours.

They are next placed in tan liquors and thoroughly tanned in a solution of gambier of 4 degrees, to which 15 pounds of salt and 45 pounds of alum have been added. The liquor should be kept at this strength during the entire time that tanning is going on, which usually occupies about four days. After this, press carefully, shave the skins and hang them up to dry.

Now dampen them for the fat liquors. Extra care must be exercised to avoid green spots. A fat liquor for this purpose must not be above 15 pounds to 100 pounds of dry leather in the following proportion: Ten pounds of English sod oil, 2 pounds of neatsfoot oil and 3 pounds of paraffine oil.

After the stock has been well turned in the mill and the leather has absorbed the oils, dry again.

The tanner next makes his selections for colors. If there are any cloudy skins they may be utilized for stock of flesh colors by putting the damp skins in the mill and turning them until they are thoroughly wet. Having dissolved three pounds of oxalic acid in ten gallons of water, place the skins in the mill and work them until all clouds and marks are washed out. Then remove the stock and set it out well, drying the skins on hooks.

Tanners will find the foregoing method a successful and economical one.

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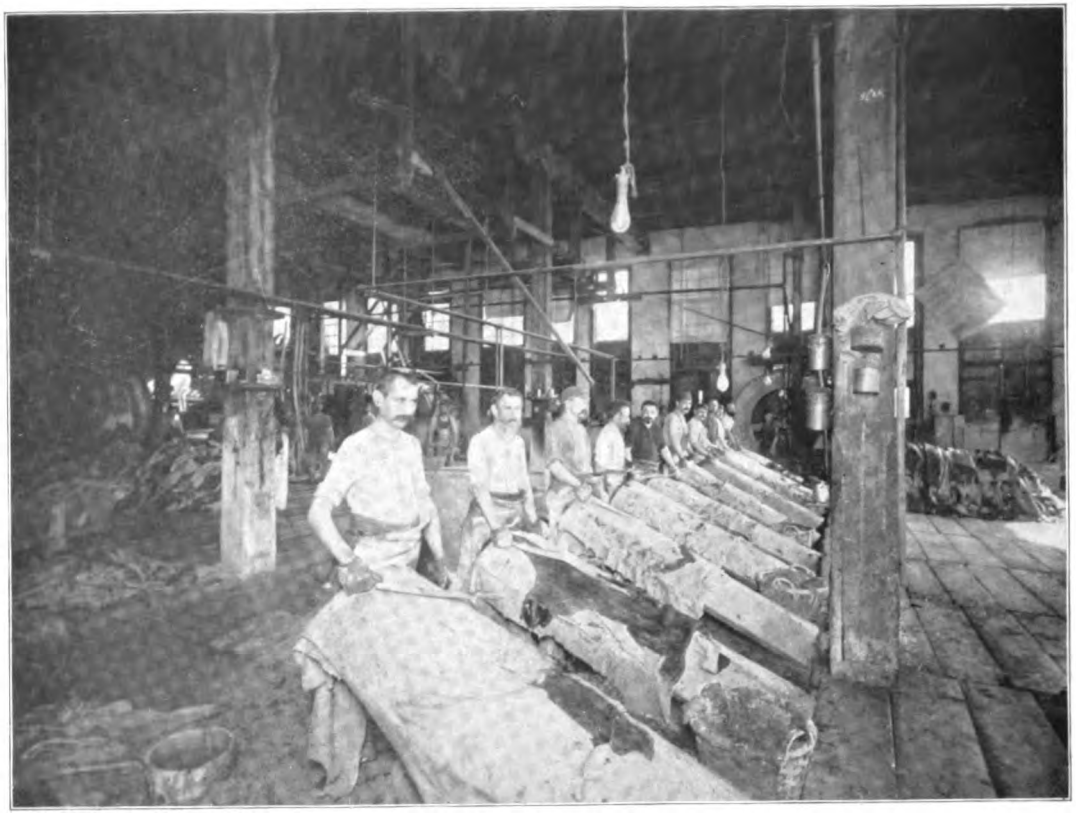

IN THE BEAM HOUSE.

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COLORING.

For coloring, place 100 skins in the mill, add enough lukewarm water to thoroughly moisten them, also five pounds of sumac, and then turn for ten or fifteen minutes. This tends to produce an even color. Then take 18 ounces of aniline dye of the desired shade, dissolve in 10 gallons of water and pour into the mill. Now turn for fifteen minutes longer, after which the stock is ready to be taken out and rinsed in cold water. This done, set out and dry as with flesh colors. When well dried dampen the leather in sawdust. Then stake, damp, and dry it again. Finally season with linseed and roll on machine.

HOW TO MAKE DONGOLA CALF.

Make packs of convenient number according to size of soaks and limes, 200 or 250 skins of nine to twelve pounds or seven to nine pounds or more of small stock. Soak thoroughly and break well, either by hand or machine. Trim and re-soak if necessary before going to limes. As red arsenic has a very softening effect in liming skins, it is generally used on this class of work in connection with lime. Make up limes in proportion of eighty-five parts lime and fifteen parts arsenic to 400 or 500 gallons water.

The first lime should be weak as 4 per cent. Stock should be hauled daily and the lime strengthened, keeping the above proportion of lime and arsenic. Lime eight or ten days. When hair slips freely, unhair by machine or hand, carefully. Wash in hide-mill or paddle vat until stock is fairly clean of lime. Flesh on machine; fine-hair grain on beam and shave heads down some. Wash again and then bate fairly low. Some tanners use solid bate for this work; others a liquid bate. Any of the known bates are good. After bating, work well on flesh, and slate the grain. Then rinse and bran drench in mill for forty-five minutes. After which, drain and put in tan. Make up liquor in same way as for goat tannage, holding calf in tan forty-eight hours longer than on goat. After eight days in tan, haul and drain well over night and oil in mill. To every 150 skins use four gallons (half cod and half neatsfoot oil). Run one hour in oil, then remove from mill and put in loft to dry.

When dry, pack down five or six days, then wet back in mill to shave, using tan liquor to dampen stock, and don't get it too wet. After shaving, re-tan in mill four or five hours, in 4 or 5 per cent.

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strength of liquor. Then put on hooks to dry. When dry, wet down in mill to color.

To every five dozen skins use three pails water and six gallons fat liquor. If a good yellow flesh is desired, dissolve four ounces auramine in boiling water and add it to fat liquor. Run stock forty-five minutes in fat liquor, after which color and strike out on grain and oil off with half cod and half neatsfoot oil.

After oiling put in hot room to dry. When dry lay in dust to dampen for staking. Stake well on machine, flesh up. Air off and pad grain, then put in perch and arm-stake flesh and slate grain. Turn and trim and measure. Then oil off, and pack down in oil over night, black to black. The next day wipe off grain with flannel, and stock is finished and may be sorted and dozened to ship away.

LEATHER SPLITTING.

A practical leather splitter was not far wrong when he said that to properly split a side of leather was one of the most difficult propositions that confront a workman in the whole line of mechanics, and that the skill possessed by edge-tool workers in leather is the wonder of all skilled workers.

A whitening slicker, or shaving knife, is the despair of the machinists or woodworkers. The ingenuity and skill focused in tanners' tools are seldom realized by those who use them.

A side of rough leather is not of regular outline. It is lumpy, has hummocks on the hips, and the butt is of uneven thickness, and uneven degrees of hardness. And worst of all, it is elastic and stretchy, the fibre compressing together like rubber under the pressure that has to be applied in the splitting process.

The careful hand shaver simply secures a relatively true beam and knife and pares down the thick parts of the leather until the skin or hide on which he is at work is comparatively level. Cleverly and delicately he goes over and through the varying thicknesses of stock under his hands. The chips and shavings of the shaver are not worth much, but the splits and pates, which are the splitters' chips and shavings, are so valuable as to be scarcely classed as a by-product.

TEMPERING.

Like iron or steel, leather acts better under some conditions than others. The Bessemer steel worker moulds his material at white

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heat, and the metal magicians manipulate steel for tools while hot and malleable and then temper it afterwards.

Metal heating and tempering are separate trades. The tempering of leather is also worthy of an attention that it seldom receives.

I have taken acid sole leather, after it was dead tanned and rolled, and have split it for seven-ounce wax upper, and accomplished a good job. The upper was fine, clean, cheap cutting stock; the flanks were well filled, and the fibre sufficiently tough for backs. Most of this leather would have stood crimping for fronts.

Of course, I employed unusual and heroic methods of tempering or sammying. Sammying is a very important work, and should be done with great care. Not infrequently it is left to a careless, stupid fellow, who neither knows nor cares about its significance. This is especially unfortunate where the foreman is not a practical splitter, and does not give the necessary attention to this department. Practical splitters, realizing the urgent need for their stock to be in prime condition, are not backward in speaking their minds openly, and this has given splitters the reputation of being cranky and even profane.

KNIVES AND MACHINERY.

It sems a wonderful thing to split leather to the graduation of one one-hundredth of an inch, but the trained fingers of a skillful operator recognize much finer distinctions.

Expert splitting requires a machine that has been carefully built and adjusted. In years gone by the old-fashioned splitting machines lacked the skill and finish of the machines of to-day.

Fine machinists open their eyes when they see a skillful splitter lagging up his knife bed and his machine and grinder with strips of newspapers, which grade on a micrometer gauge two one-thousandths of an inch. Some splitters, believing that a carefully graded machine is of the highest importance, waste valuable time in adjusting too finely. The roller, of course, can not be centered or turned by lagging, and usually has to be filed, often quite considerably, too, after coming from the best machinists.

The ideal edge is not only well shaped, but is uniformly clear and true throughout its entire length. A barber who spends from fifteen to thirty minutes on a razor blade, four inches long, with a true rib on its back to gauge his hone upon, would be much astonished to see a splitter bend to his work with a hone in each hand, being worked

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with lightning strokes along forty-five inches of knife, fresh from being ground, and sharp as a bee sting and as clear as a bell. This operation is done in three minutes' time, and without once feeling the edge with thumb nail or finger tips, for the splitter knows full well how to find any roughness that may be present. He places his chief guidance upon his sight and the feel of the hone.

A splitting knife is seldom of uniform temper throughout, but is ground specially for the work in hand. The varying hardness of the leather to be split requires quite a difference in grind and bevel. Some of the best knives I ever used were cast aside as useless by old splitters, because they failed to catch the right bevel, and did not grind true.

The grinding of an automatic machine looks exceedingly simple, but you will notice the splitter holds his hand upon the knife close to the stream of fire running from the emery wheel. He does this to detect any warmth which would spoil the trueness of the knife or injure its temper.

PROBLEMS IN SPLITTING.

The difference in thickness and density of leather has a marked, or rather cut effect, upon a splitter's work.

Leather is elastic and compressible like rubber, and the fibre is packed together as it passes over the knife. Operatives have to watch their work closely when splitting. Different parts of a side of leather are not equally hard or firm. The back, for instance, is generally more firm than the belly. It will be seen, therefore, that frequent adjustment of the top screws of the machine are necessary to achieve the best results. A thick side requires more pressure than a thin side and consequently would naturally run heavier than a thin one, which means changed adjustment of the machine.

Then, again, a dead tanned side is much stiffer than one just struck through, and it cannot be denied that some sides in a pack are always tanned more than others. Careful, satisfactory and profitable splitting, therefore, is only possible when splitters pay the closest attention to their business, and make the right adjustments.

The difference in hides is interesting. Leather made from murrain stock is harsher than a vealskin. And a poor, long-haired hide makes leather inferior to that from well-nourished, short-haired stock, and packs or compresses less. Consequently too much attention can not be paid the delicate business of splitting leather. It would be

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easy to run down a murrain side and thus turn it into an L grade, which sells from 1 to 2 cents a foot less, entailing a loss of from 20 to 40 cents, although the difference in thickness is only one one-hundredth of an inch, that is between L M and L grade in common plow shoe stock. As a bull hide is heavier in the belly, and an old cow is lighter on the shoulders and heavier on the butt than a heifer hide, it is necessary that the machine be made to suit the different thicknesses of material, or serious trouble will ensue. By careless splitting, a plump side would be so cut down as to make it a No. 2 instead of a B, and a brewers' boot side of leather could easily be reduced to plow shoe stock, representing a loss of 2 cents a foot in the former, and about 4 cents a foot, or 80 cents a side, in the latter.

SKILLED LABOR.

When it is known that there is such a difference in the quality of hides, I often wonder why tannery bosses quibble about ⅛ cent on a side of the piece work price of splitting leather. It is also questionable policy to let a skillful man go, whose habits are slightly irregular, and if I were an employer I would think twice before putting apprentices to take the place of skilled men at the splitting machine.

When I had learned my trade, all but splitting, my boss told me it would cost him $1,000 to teach me to split. I thought he was mistaken, and in this case he was, for the old splitter in the shop was a man of inferior training, and very ordinary intelligence and judgment.

As a general proposition it is safe to say that it costs considerably more than $1,000 of the boss' money besides the $125, which is the standing price which the "jour" charges for his services as teacher. Unless the apprentice has keen perception and good judgment the work will be inferior and he will destroy and waste more leather than his wages every day, and some days many times more. Work under first-class conditions can be run on a gauge of one one-hundredth of an inch ninety-five sides out of one hundred, and the micrometer on the measuring machine, which shows graduations of one one-thousandth of an inch, makes it easy to prove which splitter is doing the best work when eighteen or twenty men are splitting on the same work, if the splitter's mark or stamp is always put on.

The elasticity of leather is one of the worst obstacles to be conquered and managed in splitting and shaving.

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To split 200 sides a day or 4,000 feet of leather, which is not unusual for a first-class man, requires peculiar and unusual talent, or knack. The side or skin is stretched at the same time it is being split. And I have always contended that the best preliminary training for a splitter was to first become an expert setter, for there is much in common between splitting and setting.

Sides differ in outline and back line. To set a crooked-backed side so as to make it straight is one of the arts few setters have acquired. It needs a special talent for placing things, and is practically like a game of checkers with each separate side, besides calling for the strength and activity of a coal heaver. If the play does not win, the setter must pull up and try again, or an unsightly, crooked-backed side is the result, and in harness and strap leather this is a very serious and expensive blemish.

RESPONSIBILITY OF BEAMHOUSE.

As the foreman of the beamhouse is frequently a man who was put in that position on account of his push and energy and ability to drive, his actions sometimes give the splitter and setter cause for righteous wrath. A little skill or care on his part would often save his men many extra strokes and causes for headache, and save the boss many good dollars.

The best efforts of splitters cannot entirely remedy poor work in the beamhouse. The splitter, however, has other causes of complaint against the beamsters. No matter how much pressure or flexibility a splitter puts under and into a plate, any gouge on leather caused by machine or hand fleshing will show in a side of grain or wax of from $2\frac{1}{2}$ to 7 ounces, very plainly. And if the foreman happens to put his fingers on the light spot, he is likely to say things rather than ask for explanation. If the splitter tries to explain, what he says is not always received in a spirit of sincerity or truth, but rather regarded as an ingenious effort to cover up careless work, or lack of skill with tools, with skill in talk.

VIGILANT FOREMEN REQUIRED.

I have known splitters who when closely supervised were fair workmen, but who drifted into lax and careless ways and did shamefully ragged work, when under an easy and indulgent foreman with whom they had some kind of a pull. As foremen are not always prac-

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tical men, the splitters can do much to keep him guessing. He and the beamhouse foreman are likely to be faithful and industrious, enjoying the full confidence of their employers. I have known instances where such men, however, have combined to get rid of a splitter who in his anxiety and enthusiasm for good work made suggestions or criticisms about the beamhouse methods.

If a side of leather is run through the splitting machine too flat or level, it is sure to result in gouges or fingers, which will result in reducing a good B side to a No. 2 and mean the loss of from 20 to 40 cents to the boss.

On the other hand, if a side is run through with too much bag, it will have a bad effect on the best part of the leather, and result in artificial flanks on the butt, representing a loss of at least 40 cents.

If a back is drawn at a wrong angle to the knife, it will be run down and gouged, thus proving expensive to an employer. If the side is pulled through carelessly by hand, it will result in "sets" upon the flesh, especially if the stock is too wet or the plate is too stiff. The foreman is sure to see these set marks, and he will rightly conclude that this splitter is a poor, pottering workman.

EXACTING AND DANGEROUS WORK.

As the pulley roller is revolving at a high rate of speed, and any moment of inattention is likely to cause a broken arm, or one pulled out from the shoulder, it will be seen that the work of the splitter is not free from serious risk of bodily injury. True, good splitters, steadily employed, can make $5 a day, when in good health and spirits, but I cannot understand why bosses with intelligence and supposed feeling of humanity will refuse to equip splitting machines with safety clutches so as to reduce all chances of danger to the splitter to the lowest point and thus give him more control of his work.

It is also somewhat unfair and tyrannical of bosses to insist that a class of workmen such as splitters should remain in the shop ten hours, when eight or nine hours of such ceaseless vigilance and activity as are required in splitting leather properly will exhaust the strongest men.

No man can do high class work when tired. But in spite of all obstacles and difficulties, I have seen work so perfect that the most careful thumbing of the leather from belly to back and from pate to butt could not discover gouge or hollow—work on which belly shav-

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ing was an almost useless formality, and which when finished would be the delight of the cutters in shoe factories.

No splitter, however, except in a small shop where the function of splitter and foreman are united, could claim full credit for such work, for, before he got his batch, the boss splitter has done some sorting, which was of vast importance.

DUTIES OF BOSS SPLITTER.

The boss splitter is usually the foreman of the splitting room, and frequently superintendent of the works as well. He is no walking boss, whose duties are simply to stay around and maintain discipline.

In addition to "driving a team" of from twenty to eighty splitters and shavers, he has to sort every side which is tanned, also select to gauge, that is, to specify to the one-hundredth of an inch how the leather must be split.

His opportunities for making or losing the good money of his employers are vast. Let us suppose that he runs a shop which turns out 1,000 sides daily (there are shops that handle more than twice that quantity). As the sammied stock will weigh 20 pounds to the side, and every side must be handled more or less, it will be seen that from 20,000 to 40,000 pounds pass through the fingers of the boss splitter every day. He must, therefore, be a man of well developed brain and muscle. Some shops turn out a mixed product, such as harness, skirting, strap, card, bag, welt, insole, brewers' boot, plow boot and shoe grains, wax upper, satin calf, etc., and if the strap, bag or skirting is finished in colors as well as russet, the varieties of leather are increased, and it will be seen that the sorter requires quick eyes as well as sharp wits.

To tell at a glance whether a side of leather is properly and profitably suited for skirting, harness or insole, which sells by the pound, or for strap or welting, which sells by the foot, requires close familiarity of the boss splitter with all the work of the currying which follows the splitting. He must be a man of figures besides possessing the other requirements I have mentioned.

FATLIQUORING HEMLOCK UPPER LEATHER.

If makers of hemlock tanned shoe leather would observe the following simple directions in fat liquoring they would save themselves considerable trouble.

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After stock is dyed or blacked (in mill of course) press out surplus water by machine, or with copper slicker by hand, and fat liquor, as follows: Heat mill with dry steam for five or six minutes. Drain out condensed water and put leather in drum. Close mill and run seven or eight minutes to give stock a chance to heat and open out. Next add fat liquor through hub, not more than 2 gallons at a time, with interval of five minutes, then 2 gallons more and so on.

Ten gallons is enough for twenty-five sides of twenty foot leather, four ounce stock. As no egg yolk is put in this fat liquor it may be heated to 120 degrees Fahrenheit before putting in mill.

Run thirty or forty minutes, until absorbed. At end of this time nothing should be left in mill but water. Remove from drum and horse up some hours, or hang it up in order that fat liquor may go into all the fibre. Then strike out. Apply coat of good neatsfoot oil. It may then be tacked on frames or hung on sticks.

To make fat liquor for above: Put 10 pounds good potash soft soap in a clean barrel with 4 or 5 pails of water. Turn on steam and boil until soap is thoroughly dissolved. Next take 4 gallons of best neatsfoot oil and cut it by pouring into it a few ounces of dissolved borax (4 ounces borax dissolved in a quart of boiling water), and stir thoroughly through the oil. Add this to the soap in barrel. Melt 10 pounds French degras and put in with soap and oil, stirring thoroughly. Next run into barrel enough cold water to make 50 gallons. This will cool solution, when it is ready for use.

MANUFACTURE OF FLEXIBLE SPLITS.

After splits are selected at the belt knife machine, take them to the drum wheel. Then dissolve half a bale (a bale weighs about 250 pounds) of gambier, or the same proportion of extract, in a barrel of water, so that the liquor will stand at 80 degrees barkometer. Now bring this liquor down to 25 degrees by adding 6 pails of sweet liquor, 12 degrees barkometer. Put the solution in the mill, and let the splits follow. Close judgment must be used here. If the splits are large, mill for forty-five minutes. Remove and leave in piles for say twelve hours. Then throw them in a vat containing 20 to 25 degree liquor, and leave until well tanned, say three or four days.

Take splits out and put in washwheel with plenty of lukewarm water through the axle of the wheel. Have plugs in wheel so that impurities may be washed out. The wheeling should occupy twenty

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to thirty minutes. Now take 50 gallons of water, to which add 4 pails sumac (about 20 pounds of sumac to a pail) and 1 pound of alum. Cook to the boiling point. Then let cool to 110 degrees. The splits meanwhile are still in the wheel and to them should be added from 4 to 6 pails of sumac liquor just made, and the wheel run for about thirty minutes at sixteen revolutions per minute. Remove and rinse leather in clear running water.

Now heat 50 gallons of water to 120 degrees, into which put 2 quarts of sugar of lead. In another barrel of water containing 50 gallons put 1 quart of vitriol. Immerse splits first in sugar of lead solution, then in vitriol solution, then in clear, running water. The leather is now ready to be sammied in the usual way like satin or wax splits.

After this is accomplished and the leather ready to set, it should be put under a setting machine and well set, and then rolled down fine and soft. For setting the splits should be as dry as possible. For instance, 100 pounds dry splits should not have over 35 pounds water after they are set by jack or hand. Now make the following: Three pounds Irish moss and ½ pound soap, and cook with 3 gallons of water and strain. The mixture, if properly attended to, will resemble a heavy cream. Set this on one side and apply a coat of it liberally to both sides of the splits. Then hang up in a warm room. When dry take down and leave in a pile to press for a day or so. Now prepare the following: Three pounds Irish moss, ½ pound chip soap, ½ pound starch. Dissolve this in cold water, say 4 gallons, and cook well. The result should be a heavy substance.

Take splits to jack. Have one man at jack and one man to apply the mixture to flesh side first, taking the splits one at a time, giving liberal dose to the flesh side, at same time running through the jack in wet condition. Be sure and keep one split ahead of the machine. Hang up to dry them, take down and go over grain side same as flesh. The leather is now finished, and if this process be carefully carried out as instructed, it will be found to be one of the very best ever used.

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Rough Welting and Card Leathers.

ROUGH LEATHER TRADE.

The manufacture of rough leather is one of the links connecting the present with the past in the world of leather.

Time was when the making of rough leather exclusively occupied many more tanneries than at present. Keen competition and closeness of profits, however, did much to enforce the currying and finishing of leather under one roof.

The manufacture of rough leather is still a pleasant and successful business today and there will always be a steady demand for it.

There has been such a material change in the use of hemlock rough leather during the last ten to fifteen years that tanners are compelled to study their business more closely than ever and to produce the kind of leather, that is most salable, otherwise they will be burdened with undesirable stock, which is a condition sometimes preceding enforced retirement.

In line with the higher quality and greater perfection expected in all kinds of merchandise today, rough leather must be thoroughly worked and fully tanned and the grain side kept as clean as possible, as cloudy or unevenly colored leather is unpopular with buyers.

OLD-FASHIONED LEATHER.

The old-fashioned method of rough leather tanning produced a birdseye grain on the stock, but this is avoided today by suspension in liquors, instead of laying the hides in the vats.

Birdseye grain was all right when pebble grain leather was fashionable. At present smooth grains are mostly wanted, which means less work and less cost in currying shops.

It is admitted, however, that suspended leather put through the liquors in the good, old way commands top prices in the leather markets today.

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The present demand for rough leather now consists mainly of stock adapted to the manufacture of card, russet and welting leathers. The limited quantity of rough leather sold to be finished into black includes only the light and cheaper grades.

Card leather requires rough leather absolutely clear of scratches or damage of any kind upon the grain, and freedom from cuts upon the flesh side, with plump shoulder, good pattern hide, and thoroughly tanned.

To comply with these conditions it is easy to see that but a small proportion of tannery product is suitable for card leather.

Russet leather can be used in all weights, but must be clear on the grain both from imperfections and stains, and while a light color is desirable, an even color is the main requisite.

It is undeniable that well tanned stock is insisted upon by the finishers of today, who have but limited arrangements for re-tanning. Both card and russet leathers are but selections from the invoices as they come along, buyers being so particular about their purchases that it is seldom that an invoice can be sold to them without the privilege of rejecting such hides as do not suit. True, for these selections the highest prices are paid, but buyers are so particular in regard to getting the most desirable stock that the value of what they reject is so much reduced after the culling as to give tanners cause for complaint.

It is important for rough leather tanners to study their business very closely so as to fully satisfy the requirements of buyers, particularly in the case of rough hemlock.

Tanners have to pay more attention than ever to their product, or it will be but a question of time when they will be forced out, or do their own finishing or enter some other line of business.

No one can deny that there is quite a fair demand for rough leather today, just as during the past 25 years, when it was used so largely in the manufacture of pebble and glove grains. Looking back it can easily be seen that considerable work and expense was put into the leather, that could have been saved if the tanner had split the stock, when partly struck through, and finished it himself.

Besides being thoroughly tanned and properly worked it is of the highest importance that the leather be kept free from stains, either from the sides coming into contact while in the coloring liquor or from getting cloudy or unevenly colored while passing through the handlers.

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WELTING LEATHER.

Welting leather requires a good, even tannage, although the quality and color is not so important as for leather intended for grains, as rough welting brings less money. It should be well worked, well tanned and have good shoulders and flanks. Both first and second selections are used in considerable quantities and there is every indication that the demand for rough leather for welting will increase.

If rough leather tanners will be as progressive as the manufacturers of all products should be, in this age of sharp competition, if they will examine closely into the workings of their plants in the minutest detail and find the way to make the leather that is needed to supply the demand for choice stock, preventing the damage so often done in the beamhouse or tannery, and if they will produce this well worked, well tanned and even colored leather, there would seem to be no doubt that they have a business that will be profitable to them.

Too many of them have been content with their product and have been unwilling to change from the routine they have followed for years; but it is true in tanning rough stock as in other lines that one must progress or fall behind.

All possible economies should be practiced, yet the stock must not be allowed to suffer from neglect or carelessness in carrying these out.

Of late, there has been but little encouragement for tanners of rough leather to run their plants to full capacity, owing to the high prices at which hides have been selling, and under such conditions in raw material new tanneries are not being started.

While the making of rough leather is hardly likely to be as large as it was formerly, most of the rough leather tanneries now running have materially enlarged their capacity.

MANUFACTURE OF ROUGH LEATHER.

Rough leather is a grade of leather that almost every tanner has had some experience with, southern tanners especially. If they have a lot of hides they will class them in lots; some to finish for home trade and the remainder to be shipped in the rough. Some claim that they "can't make any money by tanning in the rough, but it is the quickest way to turn it into money."

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Tanners who have been following in the footsteps of their forefathers, making wax upper and harness, are now finding that they cannot sell their stock to an advantage when finished, as they could a few years ago. For this reason they are compelled to put out some in the rough. There are some tanners today who are tanning leather as they did thirty-five years ago and shipping a proportion of it in the rough. The fact is, they never read anything that would suit the arrangement of their yard. The articles they read on the manufacture of rough leather generally require some machinery in the work, and for that the small tanner has no substitute.

So in this article I am going to try to write something from which the small tanner can derive some benefit. In fact, I intend this more especially for the southern tanner.

First, say, I take a pack of fifty hides, 40 to 50 lbs. average, and carry them from beamhouse until tanned.

A pack of green salted hides should first soak about twelve hours (in winter twenty-four); they should be taken off the pile, shaken and thrown in the water, flesh down, so as to let all the salt and blood dissolve and the grit drop off the flesh that will, for grit soon dulls the fleshing knives. After they have soaked thoroughly they should be handled up, split down the back and thrown in another clean water. I will say nothing of the tanners' trim as I believe in as much staying on a hide as possible, when it is to be sold in the rough.

FLESHING.

After the splitting of the hides comes fleshing. There should be more pains taken with the sharpening of a fleshing knife than any other tool in the business. If a turned edge tool does not cut well, all the harm is in time that is lost, but when a fleshing knife does not cut properly it butchers up the hide so that it will be seen after the hides are finished. A first-class beamster is, in fact, of more importance than any other workman in the tannery. Some beamsters take too little pains in sharpening their knives. A fleshing or fine hairing knife should never be ground lengthwise on the grindstone. They should be ground just as square as a carpenter's plane. If the belt (or crank) runs too close to the stone to grind it square across, you will save time by moving it farther away. Then you ought to have a bevel on each edge of at least half an inch. After the knife has been ground it is then whetted with a clearing stone, which

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is termed the beamster's "fiddling stone." The knife is whetted with long strokes lengthwise until all the wire edge is removed.

The hides are then fleshed ready for going into the lime. In fleshing it is not necessary for all the membrane to be removed. The butt should be fleshed clean, but the rest is not necessary. All the fat and flesh on the hide should be removed with the smooth edge of the knife. The skiving edge should never be used anywhere except on the head and brisket.

LIMING.

Liming is of more importance than any part of the tanning of rough leather, or any other leather that is to be sold by weight. One barrel of lime is sufficient to lime 100 sides; that is, if it is good lime. The foreman is the best judge of this, and he ought never to be absent when that work is to be done. Beamsters will sometimes put in lime that will not slack, thinking it will make the hides easier to unhair, but this is a mistake. All good lime will slack, and lime that does not is of course not good, and is injurious to the hides. In slacking lime it is not necessary that it be slacked by degrees; fill the lime box with water just as soon as you put in the lime. When it begins to steam good, stir it with a shovel, pull up the gate in the end of the box and set all that has slacked into the lime pool.

Continue filling the box with water till all that will slack is slacked; the remainder should be thrown on the manure heap. If care is not taken, there will be some lumps of lime that will get out through the gate when it is pulled. If the gate is at the bottom of the box it will be best to put the shovel before it to prevent the lumps from going out. It should not be turned into the pool while it is thick; enough water ought to be put in to make it thin. Then there will be no danger in it caking on the bottom.

After the lime is prepared and hides put in, they should be reeled up daily for five or six days, which is ample time for liming green salted hides; of course flints would require one or two days longer, perhaps.

Some tanners prefer using sulphide of sodium or sal soda in their limes. I have used both of these with good success, but unless I worked hides mostly by machinery I would prefer liming with lime alone, as described above.

In using either of the above agencies I would never use a lime more than once, but when using lime alone, it can be used as many

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as three times by strengthening up with thirty or forty pounds each time.

I would never advise the using of a lime more than three times, though I have known them to be used a number of times.

MISTAKES.

Some years ago I took charge of an upper leather tannery in a southern state. Arriving there in the morning the owner carried me at once to the yard to look around before going to work in the afternoon. The first place we visited was the beamhouse. There we found a couple of darkies plugging away on the beam. Looking at the limes I noticed that they were reeled up; also that the lime was very old. I asked when they had been cleaned out and why the hides were left reeled up? The oldest darky answered me by saying: "We clean out the limes every summer, and we always leave them up a good while to air." I asked what good airing did? He responded "Old 'boss' learned us that before the war and we have kept it up ever since."

Two greater mistakes could not be made. One lime should never be kept more than one month, and hides while in the lime state should be kept out of the air as much as possible.

It was well that this concern used their own leather, for it would never do for them to sell it by the pound when limed in that way.

When the hides have been limed enough for the hair to slip on the thickest part by scratching with your finger, they are ready for unhairing. They should not be allowed to stay in until the hair slips easily, though the beamsters may complain of using too much elbow grease. It is cheaper to pay for elbow grease than it is to lose weight by over liming. If steam is convenient at hand a pool of clear water should be heated to 120 degrees F. and the hides reeled in for three or four hours before unhairing. The unhairing should be done with a smooth edge knife, and all the hair from the edges removed in this operation, as it will be easier than any other time. The first operation of fine hairing ought to be done as soon as the hides are unhaired, but the second could wait 24 hours longer.

The hides ought to stay in the water about four days from the time they are taken out of the lime until they go into coloring. I have know some tanners to put hides into the liquor the same day they were taken out of the lime. And I have known some to only work

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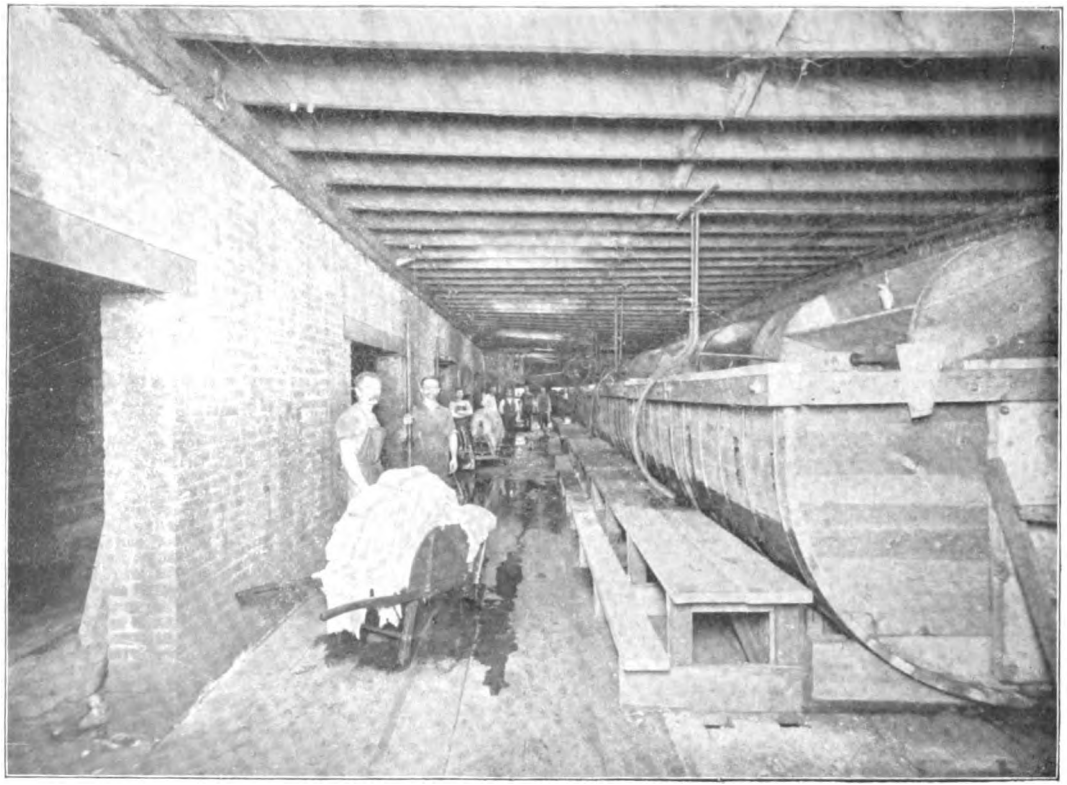

PADDLE-WHEEL TANNING.

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them on the grain once after unhairing. It does not take as long to work them the last time as the first, as there is only a small amount of lime to be worked out; that is, if they were properly worked the first time; and it will only cost a small sum to work them properly.

When they are only worked once you cannot say that they are worked properly. I have used a bate for hides after they have had the first working. When using bate, I recommend the hen dung, but I would insist on leaving the bating out when tanning rough leather, for there cannot be as good weights made when using a bate as without it.

TANNING.

Before saying anything about putting the hides in liquor, I will describe the most successful system I ever used in leaching.

After filling the leach with fresh ground bark, first soak two layaways. Then begin with the strongest handler by letting it soak for a few hours, then the next strongest, and so on, until all the handlers are run over the fresh bark. After all the handlers have soaked on the fresh bark, it can be filled up with clear water. It is some trouble to get the handlers the proper strength at first, but after they have once got right, it is easy to keep that way. The first handler (or color) should be about 3 degrees, the second 4 degrees, the third about 6 degrees, and the last one about 12 degrees. That is when there are six handlers. I would insist on using at least six if not more. I have known some tanners to use as many as ten. But hides handled through six handlers are well prepared for the layaway. Twelve hours are long enough for the first handler to stay in; and the last forty-eight.

Some tanners work up their handlers and throw them back in the same liquor. This is not necessary when tanning side leather, but when tanning kips they might be handled once in each of the last four handlers; but once is plenty for any hides to be handled in one liquor. The first two handlers should be swung in on sticks, and when changing from one handler to the other they should be turned over once, so that they will not rest on the same place. And if they touch anywhere by turning they will cause the spots to color. Some prefer using nails and nailing them to the stick. I have used the nails, but I do not believe that they pay for their trouble.

Any one accustomed to leaching as above may find it some trouble

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at first to keep the handlers the right strength. However, it is impossible to get them all exactly the right strength.

I have colored in 5 degree liquors, and the last handler 16, but experience has taught me that that was too strong.

I have used a jet steam pump for pumping the liquors on the leaches, and thought it a very fine thing at first, but finally I quit it and went back to the cold liquor pump.

The jet pump does very well when running three packs weekly, but when running one and two packs the liquors will form gallic acid before the next time to run them over, though if I were running six packs per week I would not use the jet pump.

After the handlers have been carried through the six vats they are ready for the layaway.

With the layaways the first one run over the the new bark is of course some stronger than any of the others. The first should be about 14 degrees; the second 16 and the third (if they are not tanned in the second) should be 18 degrees.

It will take a man of a good deal of experience with leach liquors to leach them right. If the liquors begin to get weak, you may know that not enough bark is being used.

In using black oak, it will be impossible to get the liquors as strong as has been described. With black oak the first handler liquor should be 2 degrees and the last handler 8 degrees, and the last layaway 14 degrees. You will find that 14 degrees is about as strong as black oak will get, even if it is doubled over several times. The above method of leaching is good for black oak by preventing it from staining so bad, though it is harder to keep up black oak liquors than chestnut oak. Black oak after being left in open shed for some time will evaporate to a larger extent than chestnut oak. This important part should be watched closely.

CURIOUS IDEAS.

It is ridiculous to think of the ideas of some tanners in regard to tanning and tan bark. I once knew a fellow who purchased a tannery that had been shut down for several years. He knew nothing of the tanning business at all, but was going to hire a tanner. The first thing he did was to write a letter to an old tanner, one who had been in the business for many years. He asked the old tanner "if he thought it would be advisable to run the yard to its fullest capacity or to go

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slow?" "And if bark that had been peeled eight years ago was as good as new?" The old fellow's reply was: "First get you a good tanner. Don't fool with a Jackleg, for they have gone up long ago. Then run with full capacity, as it takes as much bark to tan 500 hides as it does 5,000, and bark eight years old is much better than fresh bark."

It is right that every tannery owner should have a good tanner, for it pays to have an experienced man, no matter how small the tannery. But the idea of it taking as much bark to tan 500 hides as it does 5,000, and bark eight years old being as good as new bark is just too ridiculous.

The old man in giving his advice about Jacklegs should have added that when Jacklegs went up, "Old Fogies" went up in the same balloon.

Let us now take up the hides at the layaways.

The first layaway should remain about six days, the second two weeks and the third three weeks (if they are not tanned in the second).

When the hides are taken out to dry they should at first be thrown over a beam flesh to flesh and grain to grain. There let them stand for 12 hours, or until all the liquor is drained out that will. If it is convenient, heat a pool of clear water to 100 degrees F., and rinse them off in that. When carried to the dry house they should be hung up grain out, and let stay until oil will go in the grain. Then they should be thrown down in a box or on the floor and let remain a while to sammy—say about 24 hours. Then they are ready to take a good oiling.

For oiling, place one side on the floor; give a good coat of oil. Be sure to oil the shanks and all edges well.

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Sole Leather.

ACID SOLE LEATHER.

Grain making is one of the important processes in the manufacture of heavy leather. Right here I wish to draw attention to the lack of knowledge of many buyers of sole leather. Sometimes we meet a young man who never saw the inside of a tannery, appointed to purchase sides or backs. Having noticed the grain being lightly buffed by other buyers, he insists on a certain thickness and whiteness of grain, and saddens the lot of the tanner or dealer whose goods fail in this respect. I believe I am perfectly justified in saying that the color or depth of grain has nothing whatever to do with the real wearing value and durability of sole leather. People are fond of referring to the solid old-fashioned leather made in our grandfathers' days, and it will be remembered that this ancient stock was of a homely mahogany color, and would be almost unsalable today. Nevertheless it wore well, was sound and tough, and gave full satisfaction. Today the fastidious purchasers look for a pretty pink tinge and a deep whitness under the outer grain. This can be just as readily supplied as any other shade or peculiarity of manufacture, but the processes employed are not particularly beneficial to the hides.

Well, as long as it is fashionable I suppose we must meet the demand. If we are not strong enough to swim against the current we must submit to its course.

It may safely be said the milder the tannage, the better for a deep clean buff. To obtain this a slow, easy course of liquors is employed. These in the first stages are pretty well worn out, mellow and smooth for the young sides which are generally hung on sticks in order to insure an even color. Suppose we divide 120 sides between two vats, and run about six sets of vats, so that a tannery working in 60 hides a day would need 12 handling vats in order that each pack could stay a week before being laid away in sweet liquor.

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HOW TO MAKE NICE GRAIN.

The theory of nice grain is that these handlers should be weak and gradually strengthened. Each vat should be changed every day, and if it is possible the younger packs should have fresh sours twice a day. In European tanneries the green sides are often turned from vat to vat four or five times for the first few days. This action tends to produce brighter and more even color. In America it has been often proved that a slow course of treatment in sour and weak sweet liquors will bring about similar results. I don't say that a decent buff cannot be made by a more vigorous system, but it will be noticed that the prettiest grained sides are not as firm and plump as those with less depth. In some tanneries it is customary to lay away into sour lofting liquors direct from the acids. The sides must be raised once or twice, but, as a rule, they are untouched until hoisted for leach liquors.

It will be allowed by practical tanners that color and grain are made in the beamhouse and handlers. The after treatment is more for the tanning and filling. I have seen packs that were overlooked and left in the early layaways for a month or two. They usually dried out handsomely, but lacked weight and solidity. It is often puzzling whether to tan for appearance or weight. Nobody denies that a sound hide may be honestly filled up to its full capacity and rolled out firm and thick and look as handsome as a picture. But the mild looking hemlock acid sides that buff beautifully are not the sort that yield 78 pounds of leather to the 100 pounds of green salted steer hides. Talking about color, I would say that all tanners do not regulate their sour liquors as judiciously as they might. If they run handler sets they ought to be careful to keep them at different but regular standards. The yard hand or leach man who watches this important department should keep close tab on the age of the handler packs. He should see that the requisite sours are ready, as wanted. For instance, the oldest lot of sides should receive the best sour; the next should be a little weaker, and so on. It is very annoying to see drawn or harsh grain, which has been caused by stupid mistakes. Green hides are like children, and should be cared for as tenderly and watchfully. It is not luck that produces the leather that is always popular and brings top prices in the market; it is painstaking, intelligent labor.

I am well aware that some tannery foremen may take exception

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to my remarks about the setting of color and grain. No two tanners use exactly the same system, and this is right, as the manufacture of leather cannot be confined in every detail to rigid rules. In the main, I know I am right. If not, I should like to hear the experience of those who differ from me. It would be a good thing if working tanners would use their trade journals more fully in discussing practical points.

We have touched upon the sweating of dry hides. This process is interesting. It gives an incompetent man a good opportunity to cause serious loss and inconvenience to his employer; in several respects it is one of the most delicate operations in the manufacture of sole leather.

SWEATING.

Suppose we wish to tan a pack of dry hides—say fifty. They are thrown into a water vat where they lie from three to five days to soften. The time varies; longer in winter than summer. When apparently soft enough, the hides are drawn out, each one being carefully examined to see if thoroughly ripe for the sweat pits. Those who handle dry hide sole leather have noticed peculiar white spots that seriously affect its appearance and value. These spots are where the hide was not sufficiently softened. It may seem odd that a small portion of a dry hide should not be soaked completely, but actual practice proves this to be a common experience, hence the necessity for close scrutiny of each hide. The hides drawn out of the water that are accepted are split from tail to head, as sides are easier to handle than hides. They are now placed, about ten or fifteen at a time, in a hide "mill," which consists of a long arm or shaft, working violently forward and backward in a deep but narrow trough or box. During this motion a stream of water drenches the sides continuously. This aids the softening and is cleansing. The dirty water drains away. In five or ten minutes the milling is over, and the sides, thoroughly kneaded and rendered safe from white spots, are removed to make place for the next batch. Now follows one of the fine arts of tanning—skillful sweating. The sweat pits are wooden rooms, usually sunken lower than the surface of the ground and sheltered from climatic changes by a thick roof, which is often covered heavily by spent tan bark. These pits are kept damp by being flooded with water by spraying or hose. Steam pipes, fixed in the passage way in front of the pits, aid the warm temperature needed.

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The wet sides are placed on hooks that are fastened to rows of sticks, supported by uprights or hung from the roof. Gradually the place is filled; on either side are rows of sides; a broad avenue in the middle allows the choresmen to examine the stock. The door is closed tightly and by degrees the air in the sweat pits grows warm and stifling. Decomposition sets in; ammonia gas is generated. Two or three days, and the choresman, with lighted lantern, opens the door carefully and bidding good bye to fresh air enters the foul atmosphere, quickly closing up the entrance. Whew! It is not very bad yet. Side after side is pinched; the hair vigorously pulled, to see how the sweating progresses. There is time enough yet, and the visits are repeated. On the sixth or seventh day, sometimes sooner, it is difficult to stay long in the pits—the sides are slimy, the hair can be pushed off easily with the finger. Beware! The hair cells having rotted the hide will quickly follow. Accordingly, putrefaction is arrested by the sides being quickly removed from the hooks and thrown on the floor, to wait till the few obstinate ones yield to continued treatment. The pack is milled again and this time considerable hair is washed away. A short bath in an old lime follows, and then the sides are worked on flesh and grain, and made clean and sweet for the coloring process.

To sweat hides successfully takes considerable experience. The process must be closely watched and stopped immediately the hair "comes." If neglected through ignorance or carelessness, the grain of the hide becomes "pitted" or "pricked," as if a number of needles had entered it. If the damage was not checked at this stage, the grain would "run" and by degrees the hide would fall apart and be worthless. It takes a smart man to know when to stop the sweating. A thunderstorm frequently causes "pitting," if the hides are in an advanced condition. Many tanners decline to take risks, and prudently remove the hides when half sweated.

The English tanners have tried many times to imitate the system of American sweating. This was particularly so when American sweat leather, years ago, was shipped to Great Britain in quantities that alarmed her tanners. There were cases where American workmen were hired to introduce the sweating processes in English tanneries, but failed to secure the desired results. We do not know any substantial reasons for these failures. American tanners sweat hides in all

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kinds of weather, when the thermometer is in the nineties and when it is twenty degrees below zero.

COLORING AND SETTING.

After the hides or sides, as we will call them, have been fleshed, lined and unhaired, they are clean and sweet as newly laundered sheets. The young grain is delicate and susceptible, and easily stained if improper substances come in contact with it. Some tanners give these sides a light bating in order to cleanse them more thoroughly from lime. It is said that this may cause better color. On the other hand, old experienced foremen claim to be able to make as clean and bright leather as desirable by seeing that the working on the beam is well done.

The coloring vats should be prepared cautiously. Some tanners think they are doing the right thing by pumping their oldest worn-out sours for this purpose. While the sour should be mellow and weak, it should not be dirty or stringy. Foremen ought to examine their coloring liquors, by which the future of the leather is considerably influenced. An old handler liquor, that has stood quiet for a few days, is satisfactory to use. Liquors direct from old lofting vats are rather too nimble and not spent enough to make light colored grain.

Should sides be hung on sticks or reeled in the coloring vats? We should decide in favor of hanging. It is comparatively quick and easy to place a side across a stick and lay it across the beams in the vat. The young grain seems to like rest and inaction. Reeling from vat to vat tends to make wrinkles and uneven color. The sides are bound to curl up and lie in an awkward pile in the vat, and early impressions of this kind are sometimes lasting.

Coloring should not occupy over half an hour. We do not think that an hour's immersion would be harmful; all depends on the character of the liquor.

PLUMPING.

The sulphuric acid or vitriol process is the cause of the term "acid" leather. Vitriol is a dangerous liquid if clumsily used; if properly understood and controlled it becomes a valuable servant.

In preparing the baths, it is becoming the custom in some tanneries of mixing weak sours with the acid instead of clean cold water. Water is good enough, but practical experience has proved that a nicer color results when the sours are pumped in. Chemists may be able to

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give learned definitions of the cause of this. It will pay tanners to test our suggestions as judged by practical everyday work.

No matter what is decided on, let us explain the making of the baths. An average vat, suitable for hanging sixty sides, contains about 900 gallons of liquid. Into this a pail and a half full of sulphuric acid should be poured and well stirred. Vitriol is heavier than water and naturally inclined to settle toward the bottom. Hence, the necessity for vigorous plunging. Neglect of this may account for the brittleness of necks and shanks that have suffered from too strong acid. A pack of 120 sides should be hung on stick in two vats. After twenty-four hours they should be lifted out and about half the acid added that was first given. After hanging in this bath for another twenty-four hours, the plumping is completed and the sides ready for the handlers or stale layaways.

This process has a curious effect. It swells the hide, making it thick and distended, just ripe for feeding and holding in its present condition.

Now, it will be readily seen that sides may be ruined by ignorance or carelessness in plumping. In times past, when the acids were not as well understood as today, the sides were often swelled beyond their capacity and the fibre strained beyond remedy. No sole leather man of any experience forgets the dark red sides that used to crack viciously on being bent, disclosing a brown burnt interior, directly traceable to excess of sulphuric acid.

Today the vitriol process is no longer an experiment. Its advantages and drawbacks are fully understood. Some of the very best sole leather on the market today is made on the acid principle.

We may add in reference to our instructions about pails of acid, that we mean the ordinary wooden pails such as are found in every tannery. It sounds more familiar to a practical tanner to talk of common objects and measurements. They are easier understood. We also remind our readers that acid vats should be tested from day to day. One soon learns to judge the strength by the taste, and if they are too sour they should be weakened. It is advisable to let the old vats run down the sewer at the end of every ten days or two weeks.

BLEACHING SOLE LEATHER.

Nice color is necessary to sole leather. No matter how good the quality, the color of the grain must be right or the buyer complains.

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There is no need for tanners to feel blue if their stock is too dark or blotchy. They can readily bleach it.

Make three wooden boxes, about two feet deep, three feet wide and six feet long, and have a steam pipe and a water pipe connected with each. Fill about two-thirds full of water. In the first tank at the beginning of the week, put 20 lbs. of common soda and heat to 112 degrees (Fahr.). In the second tank on Monday morning put 20 lbs. of oxalic acid and heat to 112 degrees (Fahr.). In the third tank nothing but clean cold water. Now place about six sides in the hot solution of soda and leave them for about five minutes. You can keep piling fresh sides in slowly and then withdraw the underneath ones and let them drip in the top corner of the bath on a wooden trestle. In a minute or two lay these sides in the acid bath and leave them for about five minutes, slowly piling fresh sides in from the soda box. Now lift the acid sides into the third tank, quickly rinse the acid off and then, without waiting, place them on a few sticks laid over the tank, to thoroughly drip. When dripped, give a good coat of cod oil, and hang up to dry. These bleached sides should be bone-dried and finished in the ordinary way. By following these instructions the best results may be obtained.

The soda bath should be strengthened in the afternoon each day with 20 lbs. more, and at night should be run off. Each day this soda bath must be made new. The oxalic acid bath should be strengthened with 10 lbs. acid at noon, and on Tuesday and Wednesday begin the bath with 20 lbs. and add 10 lbs. at noon. Don't run the acid bath off till Wednesday evening and Saturday evening; twice a week is enough. But soda bath requires renewal every day. One man should bleach 150 to 170 union sides a day, and should have a man to oil the leather, as ready.

Don't leave the sides too long in the soda; it tends to blacken them. The acid is not so particular. Hang the sides in a dark cool place for a few days, then hurry on the drying with heat; black edges soon appear if not carefully watched. Keep the tanks from getting too cool, by putting a little steam in occasionally. Dry sides take the bleach better than sides washed from the vats, wet. Rolled sides take the color very kindly, too; but in practice a bleacher will soon see how much material and how long time is required, according to the cleanness of the leather and its freedom from lime or dark spots.

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SOME POINTS ON MAKING SOLE LEATHER.

It's the little things that count. Years ago when I began learning to make sole leather, green-salted hides used to be left a long time in unchanged water. Today, careful tanners withdraw the packs after the first day's soaking, run off the dirty water, and replenish with fresh. The day of putrid soaks is past. Tanners are saving money by keeping their soaks clean and not leaving the hides in rotten water. It is a small point, but worth remembering.

Some tanners still flesh and unhair by hand because the machines they tried, years ago, for these purposes were crude and unsatisfactory. Some tanners forget that the modern machines are successful, and decidedly economical to use. Small tanners may not do enough business to encourage their buying beamhouse machinery, but, no matter how large or small their place may be, before abandoning all hope of using machines let the tanner ask the advice of clever and courteous machinery men who may be able to give some valuable information. Some tanners can unhair by machine all right, but find it better to flesh by hand.

The sole leather tanners that I know do not leave the hides in lime for more than three days. But during this time they are handled several times, and the limes kept plunged up. The scheme of giving limed hides a warm bath, say 100 to 110 degrees, during the night previous to unhairing, seems to work pretty well. The hair, after the hides have been pushed somewhat quickly through the limes and warm water, may come off hard on the beam, but this is safer for the tanner than when the lime has so dissolved the hide matter after prolonged liming that the hair slips off almost by itself. This is all very nice for the beamsters, particularly when they are on piece work, but I would prefer giving my men a fair day's pay so that, even if the hair comes off hard and slow, they would not be justified in complaining.

Some tanners are too stingy in working the grain, after they unhair. Whether machines or hand are used, clean, bright leather cannot be obtained unless the grain is carefully and thoroughly scudded. I know places where hides for sole leather are put through a mild bate before being fine-haired and worked on the grain. It is claimed that the bating by its assistance in expelling lime from the fibre tends to make softer and smoother leather.

Union leather is liable to be cloudy and dirty on the grain on account of careless beam-work. Bad salt is also an enemy of clean

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grain. Hide dealers as a rule are willing to accommodate their customers, and it is generally agreed by well-posted men that hides cured by Syracuse coarse salt are not as liable to have dirty grain as when fine salt or harsh mined salt is used. Tanners should ask their hide men to use only the best, cleanest and mildest salt. Salt-stained leather is a nuisance and an expensive eyesore, and might be avoided if the proper salt were used in curing.

When sweats are employed, it is often good policy to give the man in charge of them extra wages of a dollar or two each week. This small premium will be a great inducement to him to attend zealously to his work. There will be times at dead of night when he will have to enter the pits and unhook the hides, so as to stop the decomposition. In putting sweated hides through the hide-mill, there should be no hurry. While there is no need to move the tender stock about too much, the work should be well done. In this connection I would insist that after soaking dry hides they ought to be specially well milled, so as to prevent any hard spots remaining.

It should be the duty of every tanner to keep a ledger account of each lot of hides put through the tannery. He ought to isolate each important lot of hides received from each dealer. There should be marked with a letter or number and carefully followed through the tannery right to the weighing-out scale in the leather loft. It could then be easily discovered which dealer it was more profitable to buy from. These suggestions may cause careful tanners to smile, but they would be surprised if they knew how many tanners there are who take chances on what they are doing, trusting to luck to come out all right.

WEIGHTING SOLE LEATHER.

Sole leather is said to be improved in appearance, made mellower in fibre and gains weight by passing through the following treatment:

The sides, after being tanned and well scrubbed with water, are hung up. When fairly well dripped, are taken down and piled ready for fixing. A quantity of glucose is now heated. To it is added a solution of Glauber's salts. This is applied to the flesh side of the leather, which is piled flesh to flesh and left that way for a short time. Care is taken not to use much on light leather, heavy sides being preferred.

The sides are now held for a minute or two in a tank of hot cod

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oil, which has the effect of driving the glucose into the leather and fixing it there. The oil is kept hot by steam in a warm-pipe in the tank. After the surplus oil has been drained off the sides are suspended straight out to dry. It is not considered wise to hang them over sticks.

When bone-dry, the leather is carefully dampened on flesh and grain and laid away to sammy for at least two days. It is now in good condition for the rolling machine, which packs it down in a satisfactory manner, and gives it a bright finish.

It is said that a side of leather can be made to weigh two pounds heavier by the addition of glucose and Glauber salts. Splate, from Germany, is also used to weight sole leather.

WHITE SPOTS IN LEATHER.

There are two kinds of white afflictions: white untanned spots and white grains in the fiber of tanned leather.

Untanned white spots are usually found in tanned dry hides, caused by imperfect work of the hide-mill after the hides have been soaked. It would seem impossible for soaked hides, after passing through the hide-mill, to be unbroken, in spots, but in practice this sometimes happens. The remedy is to soak carefully and thoroughly, mill long enough, and instruct the beam hands to examine the hides carefully when preparing them for the liquors.

The interior white spots in leather fiber result from yards carrying too much old, sour liquor. Some tanners like to pump their oldest and sourest liquors to the leaches, believing this to be economy. The most successful tanners, however, are now convinced that it is better to throw the dirty sours away and thus avoid too much acidity in their liquors.

It would be wise for tanners to keep posted on the analysis of the water they use, as the hardness or softness of it has an important bearing on the manufacture of leather. The acidity of the liquors ought also to be regulated, and to this end the moderate cost of the advice of a competent leather trade chemist is often a very prudent investment.

TO GIVE HEMLOCK LEATHER AN OAK COLOR.

Hemlock leather subjected to the following process will be rendered very much harder, and its red color made to assume that of oak-tanned leather.

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Put slacked lime into water in quantities of 1 pound of lime to every gallon of water; while this is steeping, boil together in a suitable vessel slacked lime, common washing soda and water in the proportion of 1 pound of the lime and 4 pounds of the soda to the gallon of water. When this mixture has been boiled for half an hour, allow it to cool, and then mix it with the water and lime solution; into this compound fluid put the leather to soak for a few days. When taken out, let the leather soak in a stronger lime-water mixture—2 pounds of slacked lime to 1 gallon of water—and allow the leather to steep for two days in hot weather and four days in cold; then take out the leather and pass it through water heated to about 180 degrees Fahrenheit, then rolling or subjecting the leather to hydraulic pressure.

When sufficiently pressed and dry, treat the leather to the following compound, on both sides if desired, by laying it on with a brush, and, when this compound has dried, brush off any superfluous quantity and roll the leather again if thought desirable:

11½ pounds Paris yellow.
2¼ pounds chrome yellow.
20¼ pounds pipe clay (or purified chalk).
15½ pounds alum.
15½ pounds quercitron, tannic acid or similar astringent body.
11½ pounds sulphuric acid.
3½ gallons gum tragacanth mucilage (called gum dragon).
14 gallons water.

First reduce all the solid bodies to a powder; then boil them all together, and allow the compound to cool when it is ready for laying on the leather.

The formula for this compound has been variously given in technical journals, but the above proportions are those which I find give the best results. The quercitron may be dispensed with and sumac substituted; the object of this substance is to cause the compound to adhere to the leather with great tenacity and prevent it scaling or peeling off. If this paste be dried and ground to powder, it forms a very effectual bottom wash for sole leather, as it requires to be simply mixed with water to be ready for use, and it will not rub off even though the leather be wetted.

The gum dragon solution should be prepared beforehand by soaking the gum in water for several weeks until the gum is no longer lumpy, or white specks appear in it; a slight addition of sulphuric or

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oxalic acid will enable the gum to dissolve in as many davs as it takes weeks to do when pure water only is used.

The above compound is one which very effectually hides the red color of hemlock tanned leather but, of course, it only hides such color on the surface, and a clean cut through the leather shows its red color at once.

By means of sodic dioxide the red color of hemlock-tanned leather is perfectly extracted, and the writer finds that the red extract so obtained serves as a very useful dye or stain for leather, giving reddish-brown tones. By means of this substance, the writer has completely bleached the reddest, thickest hemlock sole leather, and made it scarcely distinguishable from English oak tanned leather, without any further preparation.

GLUCOSE FOR WEIGHTING AND BATING LEATHER.

The best method of applying glucose for weighting sole leather is to dissolve the glucose under a steam pipe with addition of about 5 per cent. of water, and apply to the wet leather with a sponge or brush, just before the leather goes to the drying loft. If a small per cent. of carbolic acid be added to the glucose it will prevent the latter from souring inside the leather and thus prevent possible ill effects.

Glucose is being used to some extent in tanneries as a substitute for manure bates, and McMurtrie obtained a patent on the use of glucose in combination with dried sour cheese in 1877.

The object which McMurtrie had in view in the invention of this bate was to form a compound which, when complete, would be in condition convenient for packing, storage and transportation, and be always ready for use in any quantity. This he claims to have accomplished by thoroughly incorporating with dry pulverized glucose, or its equivalent, a suitable proportion, about 10 per cent., of dried sour cheese or its equivalent, forming a compound which might be packed, transported and stored, without danager of deterioration, and which, when added to the vats containing the skins impregnated with lime, will, it is claimed, undergo molecular transformation with production of lactic acid. The acid formed, combining with the lime, makes a soluble compound, which may be removed by washing with water, or the ordinary treatment of skins. Instead of glucose—starch, dextrine, cane-sugar or other amylaceous or saccharine substances suitable for making a portable compound, may be substituted; and for cheese,

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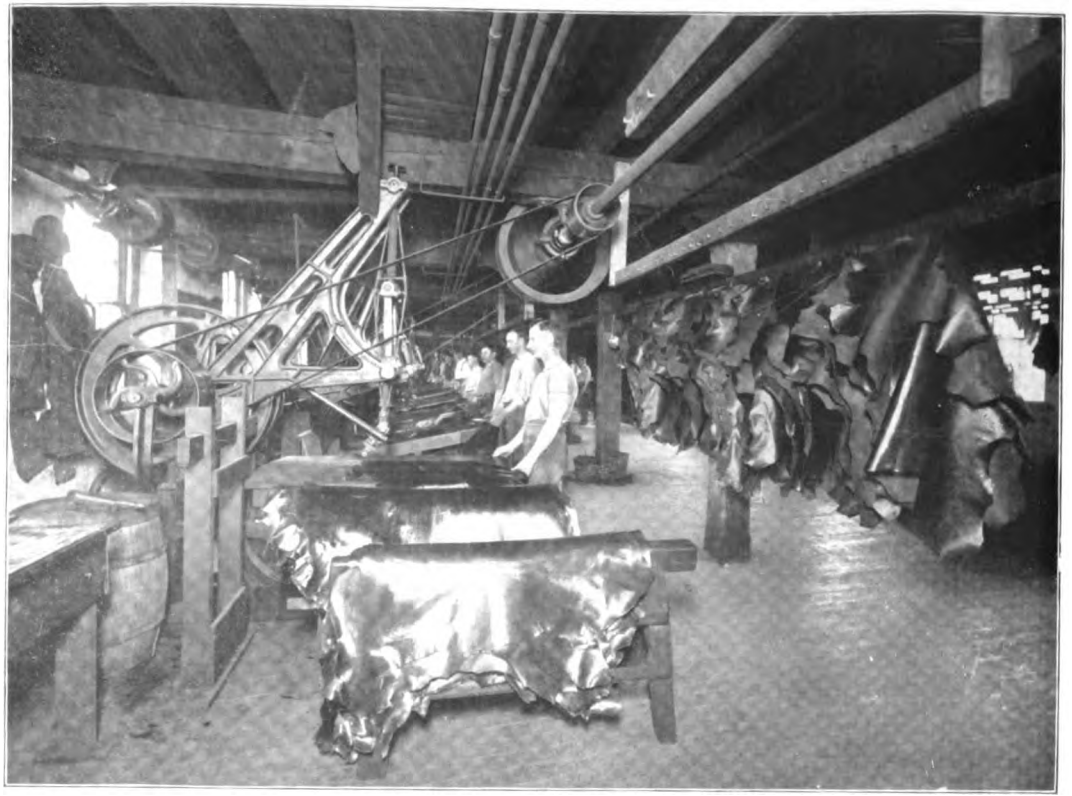

FINISHING UPPER LEATHER.

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gluten in any form, or albumen, from whatever source it may be obtained in a dry condition, it is claimed can be used. These have, however, the disadvantage of being more costly, and more hardy in their action, and glucose and cheese are therefore preferable. In case of either of these substances being used, the compound formed should be well dried before packing.

Any tanner can readily make the above bate himself. An old bran bate instead of sour cheese can be used to create a fermentation of the glucose. The only object of the sour cheese is to supply the necessary bacteria to start the so-called "oinous" fermentation of the glucose; and old bran bate or a little pressed yeast will accomplish the identical result.

FINISHING SOLE LEATHER.

Some people think it is simple and easy to dry and finish sole leather. True, it does not need stuffing or blacking like upper stock, but there are many little points that need careful watching or the best tanned sole will be unsatisfactory to buyers.

Let us take a pack of slaughter sides, hemlock tanned, ready for lofting. They are accordingly hoisted on the afternoon previous to the day for scouring or washing. It is not correct to speak of scouring hemlock sides, as they have no bloom, like oak leather, to be struck out.

The sides being well dripped, so as to leave as much liquor as possible in the vats, should be slowly and thoroughly scrubbed by the machine on flesh and grain sides. This tends to make them look bright and as light colored as possible. Right here, I would call attention to an old-time scheme of giving old layaway packs a final bath of hot, strong liquor before the washing in water. Some tanners claim this adds weight. For my part, I don't like the idea. I think I once heard a tannery foreman tell me he tried a bath of hot salt water on packs that were ready for finishing. While all of us have pet theories and schemes, I am convinced that tricks to gain weight or other advantages are best let alone.

Well, the sides, washed and rinsed in clean cold water, are conveyed to the lofts. Power elevators of small size are desirable for this purpose; few tanners should be without them. I have found it beneficial to the leather on arriving upstairs from the wash wheel, to stack it on a sloping wooden bed, and cover carefully with old bags or sail

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cloths. In a day or two, the sides are in nice condition for oiling. I will give a hint to those who are bothered with mould on the grain. It is sometimes difficult to secure proper ventilation, hence the wet sides are inclined to mould, especially in the fall and winter. Here is a recipe. Take a small quantity of salicylic acid, and dissolve it in hot water. Then put a tablespoonful of this in cod oil before smearing it on the leather. The acid seems to prevent moulding. It is sold as a white powder; only a certain quantity will dissolve in hot water. This can be readily ascertained by experiment. The acid, in my experience, is entirely harmless. It certainly effects some good.

The oiling should not be hurried or slovenly done: Every spot should be touched. Hippy places and the shanks should be given proper attention. Look out for your sticks. Keep them clean. They are liable to become black and to mark the wet grain that rests on them.

As to excluding light and wind from newly oiled packs, I don't know what to advise, as the apparently most dangerous experiments have been tried with surprisingly satisfactory results. Much depends on the condition of the leather. If the liquor has been well dripped and washed off, there is less liability to dark color and black edges. On the whole it is safest to leave the sides for three or four days in a dark, cool place, free from draughts and daylight. After that period the night watchman may open the shutters, when the sun has gone down, without fear of the consequences. Tanners have different ways of regulating the drying, but, after all, the prime, beautiful sides that attract attention and sell readily are those that show the utmost attention to detail. The smell of rough dried leather is delicious; a strange and peculiar odor, reminding one of the quiet, peaceful forests, where the bark comes from. Many and many a time have I pressed my nose against a side of hemlock slaughter leather, and fancied myself amidst the pleasant country scenes in summer, when the air is balmy and the theater of nature was in full working order.

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Tanning Furs and Robes.

TO TAN FUR SKINS WITH GAMBIER.

In tanning fur skins with gambier, the object would be to keep the skin as soft as possible. If the skins are dried out, the best way would be to soak in a solution of salt and borax, then break over the flesh, taking off all superfluous matter. When the skins are well softened, put into a liquor of gambier not over 3 degrees barkometer strength and handle every four hours until the strength is down to 1 degree. Then you can start on 6 degrees, and if handled every four hours will be tanned in forty-eight, unless the skins are very heavy, which will require discretion in tanning.

In finishing, a good way is one that has been tried: Take the skin when dry, rub over the flesh side with a pumice stone to take off all the loose flesh; then go over gently with flannel swab with a mixture of, say, 1¼ pounds of castile soap dissolved in 1 quart of water. Mix with 1 pint of paraffine oil, using just enough to cover the flesh lightly.

FUR SOAP FOR RENEWING AND DRESSING OLD FURS.

Take 7¼ pounds salsoda, 1¼ ounces borax, ⅜ ounce sulphate of soda and 8½ pounds good bar soap. Dissolve the salsoda, borax and sulphate of soda in 4½ gallons of soft water, till not a lump remains. Melt in the above solution the bar soap; cut the soap in very thin slices that it may dissolve quickly. While dissolving, keep stirring so as to mix them well. If it is inclined to boil over, throw in a little water. When the soap is melted it is then done. Remove from fire and let stand an hour, or till it is cool. Then it is ready for use.

For perfumes, if desired, add 1 ounce of oil of sassafras, just before it is cool. This makes an excellent laundry soap.

BLEACHING WOOL.

Put an old pot or other iron vessel in the bottom of a hogshead, and in the vessel a roll of brimstone, broken up. Fasten near the

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top a stick or two to place the skin on. The wool must be wet when hung on the sticks. Heat an old iron red hot, or take live coals to start the brimstone. When it is burning briskly, cover the hogshead tight to keep the smoke in. If the wool does not become white enough, repeat the process. Do not put the skins too close to brimstone fire.

SKIN MAT AND RUG DRESSING.

The most essential point to produce a good mat or rug is of course to have a suitable skin to work on, for on this mainly depends the ultimate success of the operation. A sheepskin for this purpose should be of a breed to insure a curly staple, glossy and open, and in other ways suitable for producing a first-class skin rug. It requires no little nicety of judgment on the part of the skin dealer and rug dresser to make the proper selection of skins for the purpose, and as skins are only at the proper length of staple at certain times of the year for mat dressing, mat dressers buy their supply of skins for the year through wool pullers, who are in a position to pull the rejected ones; of course skins from favorite animals are dressed of all sizes, qualities and shapes at all times of the year. After having procured a suitable skin, and if it can be procured direct (in a completely fresh condition) from the slaughter house, so much the better for the ultimate appearance and durability of the mat or rug—the skin, if fresh, must at once be put into pure water to extract the blood, etc., remaining in the pelt, and to soften the dirt in the wool; the time required for the skin to be immersed is of course regulated by the time of the year, viz., from one to three hours—this steeping process is much better done if a running stream is at hand. The next process is to work them well over a beam with a fleshing knife to remove all flesh and fat, and to work out of the pelt all impure and useless matter. When this is well done, lay the skin hair or wool side on the table and thoroughly rub into the flesh side sufficient fine salt to sprinkle the skin all over, afterwards rubbing well in a good sprinkling of pure powdered alum. As to the exact quantities of salt and alum it is next to impossible to tell, but the above sprinkling will be sufficient, the alum itself being regulated according to the thickness of the skin operated on: but a most important point is to keep the alum as much out of the wool as possible, as alum renders the wool very difficult to wash afterwards; this, in all respects, is a great disadvantage. The

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skin must lie in the alum, doubled wool outwards, for at least two days, some skins requiring considerably more time, and all skins will be benefited by a longer time in the process. The next process is that of framing—by placing the skin in a square wooden frame having screws all round it, to which are attached pieces of string which are fastened by means of a little stone, so being placed in the side of the skin that it can be screwed and stretched in all parts to its full capacity without wrinkles; it must now be dried gradually out of the sun after being smeared with a paste of flour, oatmeal and water on the flesh side. When the skin is thoroughly dry work off the paste with a round knife, then place the skin in the frame in a damp place, so that the superfluous salt will come out in beads of brine on the flesh of the skin; these must be washed off in clean water, or else the mat or rug will be spoiled by having too much salt in it, and will turn damp with similar weather. When the skin is thoroughly dried again, it must be washed and scoured with potash soap, warm water that the hand can be borne in, and a little ammonia, care being taken to thoroughly rinse all soap from the wool, and letting the pelt have as little water during the operation as possible. The skin must now be dried again by being thoroughly shaken and hung wool side out to dry. When the pelt is about half dry, it must be worked over what is called a perch, with a crutch or staking iron to draw out and soften every portion of the skin. It is next worked with a round knife, kept very sharp, after being rubbed with a ball of whiting, and finished off with pumice stone, the wool side either being dyed or combed, and otherwise trimmed and finished for use. In the case of heavy salted skins the superabundance of salt must be got out by an extended time and fresh waters in the first soaking process. As to dried skins they are delicate articles to operate on, as the wool or hair very often leaves the pelt, even when the greatest care is used in softening them in the first process of soaking; a good plan being to change them into salt and water after they begin to soften a little, so as to bind the wool, if possible. There are many more ways of tanning, curing and dressing skins, but the above is best for either fresh, salted or dried skins; but when dressing is done on a large scale, other methods have to be adopted.

FUR DRESSING.

The following recipe will be found practical and satisfactory in application in the dressing of furs:

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All skins must be thoroughly freed from flesh, fat, and foreign materials. To do this beam flesh side with a beam knife or scraper, and then scour well with salsoda and soap, until the dirt and oils are removed.

See that the skin is free from suds by rinsing in clear water, also by beaming previous to tanning.

For the tan make a strong alum water and dip skins in this for two hours. Wring out dry as possible, then dip skins in tan made of wheat bran, 1 peck in 15 gallons of water; warm, let stand until it ferments, then strain this liquor off. Add to this 15 gallons of liquor, 2 pounds of sulphuric acid (oil of vitriol) and 6 pounds of salt.

Let the small skins remain in the above tan from two to three days, and larger ones from five to six days. Rinse the skins free from the tan; let the skins hang in a shady, airy place until just dry enough to turn white when pulled or stretched in any direction. Continue the pulling and working of each skin, changing the skin round as it is pulled, to keep the fiber to an even effect.

When the skins are quite dry put them in a box or barrel with some good poplar sawdust and give them a good working. Now give the fur side a thorough brushing until the fur rises fluffy-like.

FUR SELECTIONS.

All the whole skins nice in shape and prime fur and large belong to the extra No. 1's.

All prime furs, small holes or medium size, belong to the No. 1's.

All small prime skins and large skins with small tears or a few holes are No. 2's.

The large, unprime and medium ragged skins are damaged.

FOR TANNING FURS, PELTRIES AND DEERSKINS.

(1) All skins, whether for furs, other peltries, or leather, must be thoroughly freed from flesh, fat and foreign materials. To do this beam with a knife, or scraper, and then scour well in suds of fine soap and salsoda, before any tan stuff or coloring matter is applied. Care should be exercised to see that the pelt is perfectly free from suds, by rinsing and wringing; also, by beaming previous to tanning.

(2) When the pelt is well cleaned and scoured, as above directed,

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make brine of common salt at blood heat until no more will dissolve. Then prepare a like quantity of mucilage, by passing very warm water through a fine sack filled with clean wheat bran. Also, dissolve a small quantity of good starch in warm water. Let the brine, mucilage and starch-water settle till quite clear, then pour them carefully together into a wooden or earthen vessel of sufficient dimensions to give free motion to the pelts when stirred. Place the vessel where it will keep warm for two hours.

(3) Dip the pelts in clean, strong alum water, at blood heat, for two hours; rinse the pelts free from the alum water, and wring or beam them dry as possible.

(4) When all is ready, pour into a mixture of brine and mucilage (still keep warm). Add a quantity of sulphuric acid (oil of vitriol), 2 pounds of acid to 10 gallons of water or mixture, and put the pelts in quickly, stirring them briskly as possible for a few minutes. Take out the pelts, and scrape flesh clean and dry as possible, putting back in same process for one hour. Be careful to have the mixture touch every part of each pelt.

(5) Let the pelts hang in a shady, airy place, until just dry enough to turn white when pulled or stretched in any direction. Continue the pulling and working of each pelt, changing the pelt round as it is pulled, to keep the fiber subject to an even effect. Much depends upon working the pelts at the right time; that is, when just dry enough to turn white when pulled, and by continuing the process of working until fully dry.

(6) When the pelts are quite dry they should be beamed over a beam, with a dull beaming knife, and finished by polishing the flesh side with coarse sandpaper.

COLD TAN PROCESS.

(1) Care should be taken to clean the pelts free from all foreign substances, after which place them in strong liquor made of alum and salt. This is to set the fur. Take out and beam well, then place in tan liquor made as above. Stir often. Thick skins, such as cowhides for robes, should remain from two to four days, according to thickness.

(2) All pelts should be cut down even with the currying knife before placing in tan. Furs, large and small, should be milled in

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sawdust. They are best handled in a furworker run by power, this takes out all remaining oil left in the fur.

TANNING HIDES FOR ROBES.

The hides should be very thoroughly soaked in order to get a complete softening. For dry hides this will require a longer time than for salted. A heavy hide requires longer soaking than a skin. Thus it is impossible to fix a certain length of time. After soaking, the hide is fleshed clean, and is now ready to go into the tan liquor, which is made up as follows:

One part alum; one part salt; one-quarter to one-half part japonica.

These are dissolved in hot water in sufficient quantity to make a 35 degree liquor. The hide—according to the thickness—is left in the tan from five to ten days. Skins are finished in about two or three days. The hide should be run in a drum for about two hours before going into tan and again after that process. In tanning hides for robes, shaving them down is a main requisite for success, as it is impossible to get soft leather otherwise.

After shaving, put back into the tan liquor again for a day or two and hang up to dry. When good and hard, shave again and lay away in moist sawdust, and give a heavy coat of oil. When dry apply a solution of soft soap; roll up and lay away in moist sawdust again. Now run the hides on a drum or wheel until thoroughly soft. The composition of the tan liquor may be changed considerably. If the brownish tinge of the japonica be objectionable, that article may be left out entirely. The japonica has the effect of making the robe more able to resist water, as the alum and salt alone are readily soaked out by rain.

TANNING COWHIDES FOR ROBES.

The hides should be very thoroughly soaked in order to get a complete softening. For dry hides this will require a longer time than for salted or fresh hides. The time for soaking depends on the size and thickness of the hides. After soaking, the hide is scoured on the hair side with soap and salsoda until all the scurf and oily dirt is removed. Now the hide is fleshed and rinsed until all the soap suds are cleaned out. The hide is then ready for the tan liquor, which is made as follows:

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One peck of wheat bran in enough warm water to make a slop solution. Let this stand until it ferments, strain this sour liquor off. To this add 20 gallons of water strained through the same bran to get all the fermentation out of the bran. Now add to this liquor 2½ pounds (oil of vitriol), viz., sulphuric acid, 7 pounds salt and 1 quart hemlock extract. Now drain to shave, then shave the hide down to the desired thickness, put the hide in the same tan bath and let remain four or five days, or six days if the hide is extra heavy. Now the hide is ready to hang up to dry. When dry dampen and stake until soft. Now take tallow one part, neatsfoot oil one part; mix to a stiff dubbing and apply to the flesh side about the thickness of the hide. Hang the hide up to dry; when dry scrape off the remaining grease and apply a thin coat of good solution of soft soap; lay away over night, or twenty-four hours, then give the flesh side a good slicking out with a sharp slicker. Now give the hair side a good brushing and cleaning and the robe is ready for use.

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Harness, Skirting and Saddlery Leathers.

MANUFACTURE OF HARNESS LEATHER.

Hides for this work consist of heavy cows and steers, those ranging from 60 pounds and upward are in most demand for harness leather manufacture.

It is quite important that the grain and flesh should be free from imperfections, for this stock is not split, which in a great measure removes the defects from the flesh side.

In preparing hides for the beamhouse they should be first soaked in fresh water to draw all blood and salt. After soaking draw out, to flesh. Then split them down the back strip, being careful to carry a steady hand and a smooth, keen-edged splitting knife.

The sharp or cutting edge of the flesher should not be used on body of hide, except at or near tail, flanks, or head portion, where excess of tallow or meat is left on in skinning. The small nerves on hide should be broken, if not removed. This can be done by vigorous strokes of the smooth edge of a concave knife. Should these nerves not be broken at this stage, the hide will ever after present a contracted, baggy appearance; and, besides, it will be difficult to force the tannic acid to the cells from the flesh side.

When the nerves are fully broken the hide becomes thoroughly relaxed and has a more supple, flaccid feel and appearance, readily adapting itself to all the subsequent manipulations in tannery and finishing room.

A slit should be cut near head and tail one and one-half inches long, for the purpose of pinning the hides together before going into the lime. After fleshing, soak again, then draw; after drawing, put in lime vat.

Wooden pins or keys four inches long, three-quarters inch thick, three-quarters inch wide, are used to key the hides together. In center of key cut a slot one-half inch long, about same in depth. Ends of keys should be tapered off to one-quarter inch. When ready to put

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hides in the lime commence by pulling the slit from the head of No. 1 through the butt slit of No. 2 and insert the key, throwing each hide into the lime vat, as connected. Continue until the entire pack is keyed together.

LIMING.

Put hides in weak lime first. Reel twice a day. Plunge the lime well, increasing its strength; reel every day until hair starts or loosens, which will be from five to eight days. Unhair and put in fresh water; reflesh and put in bate. Hides can be reeled into a vat of water and then unhaired.

It is not advisable to lime these hides too high or to bate too low. About 1½ bushels chicken manure for forty-four to fifty sides; the manure to be put in a tank of warm water and allowed to remain until it ferments; then run the liquor off for use. Again fill tank and wash off, as in bark leach. Tank to have false bottom packed with straw. The residue of tank to be thrown on manure heap and not in the bate vat. Chicken manure of summer and fall is of greater strength than that of winter and early spring, therefore it is impossible to specify the amount per pack.

BATING.

No set time can be given for properly bating the hides. Much depends on their condition, the water and the weather, to fully deplete and fit them properly for entering the liquor vats. Handle in bate; scud and work all lime and impurities out of hides. They must be free from lime, especially if hemlock is used for tanning. The scudding process does not often secure the attention necessary to remove all dirt, lime and fine hair from the pores, particularly for hides intended for dressing purposes.

It should be the aim in liming and bating the hides to protect the flanks and loose portions as far as possible, and have them go into the liquor in a fairly plump condition.

Molasses is also used for bating hides in place of chicken manure. Many patent bates are used as substitutes for chicken manure.

After hides are bated and worked out, throw in fresh water for a short time to rinse, then draw out, and they are ready for tan liquor.

TANNING.

Hides suspended in vat or handlers will produce plumper leather

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and fuller flanks and shoulders. Rocker handlers are best, as they save time and labor.

Leave in the handlers until sides are well plumped and struck. Take care not to have too strong liquor. Exchange liquor or strengthen until sides are ready to lay away in vat.

For first layaway fill your vat with as much liquor from leach as needed. Should liquor of too great strength be used in first stages the pores of the hide become clogged, producing tinny and crusty leather, and in a great measure the inner or more gelatinous portions are prevented from receiving the proper supply of tannic acid. Sides are piled in vat, with layer of ground bark between, and they should have four layaways.

Sides should be skived out of third layer; the liquor to be heavier for each layaway. Or, after fairly struck in handlers, handle in same liquor as you would have first layer, by throwing them up occasionally in pile, and change liquor. Then give a layer of ground bark with a first run of liquor and let the leather remain to fill and ripen up. When skived handle in good liquors.

Harness leather, after being tanned, is scoured or well slicked out on the flesh side. Scour and slick out on the grain and go over that surface several times until all the old grain is distributed. Finally, apply a dressing of oil to the grain and hang up to sammy.

When excess of water is fairly absorbed, take sides down and dampen those portions that are too dry. Care and good judgment is required for this work. If too wet, and stuffed by hand, the leather will not hold the set; if too dry, the grease tends to discolor the leather. The damping down ought to be done ten or twelve hours before stuffing, so that the moisture will permeate the leather and become evenly distributed.

If leather is stuffed by hand, sides are "set" on grain side with a stone.

First apply a small portion of dubbing on flesh side so that it will adhere to table; then go over the grain with stone and set out good. After this, go over with slicker, then apply a dressing of cod oil. When grain is set the leather is then set out on the flesh side with a good slicker and a mixture of oil and tallow applied.

When a side is taken off the table and hung up to dry, care should be exercised that the set be not destroyed. Then suspend the sides from tail to head on racks; dry slow and without exposure to light or

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strong draft of air. When partially dry remove sides and stone and slick on grain, which will clear off all traces of old grain, and give the leather a firm, yet mellow feeling. It does not hurt to give a dressing of oil on grain along the backs. After resetting, hang up again to dry.

BLACKING.

Harness leather after drying is taken down and put in pile, and ought to lie two or more weeks before being blacked. Many a side of leather can be buffed where there are imperfections on the grain caused principally by the cattle coming in contact with barbed wire fences. Such sides, unbuffed, would be B selection. Care should be taken in buffing harness leather not to remove too much, nor cut too deep nor wide blotches. After sides are buffed they are taken to blacking table and piled up in packs of fifteen to twenty-five sides.

For mordant use soft water, salsoda and logwood. Place the ingredients in a coarse sack in a barrel, holding about fifty gallons, and fill nearly full of soft water. By direct steam connection force steam into barrel until near a boiling heat. Raise and lower sack at intervals in barrel; apply mordant hot to the grain with a stiff bristle brush. Keep the sig at all times at an even temperature or near boiling heat, as it is spread on the leather in small quantity and thoroughly rubbed in with a stiff brush. Be careful not to put on too much sig, but rub in well, until grain is mellow and surface grease is cut sufficiently to readily absorb the black.

Blacking is applied cold and by a softer brush made from horse hair.

Many curriers still adhere to the use of soda and urine for a mordant. Salsoda is now used extensively for the work and is much cleaner and effective. Do not use soda of too great strength, else when the leather is dry a white scum will appear on the grain.

The great secret of obtaining a good black is to have the grain properly prepared with sig before blacking is put on. After sides are blacked and partially dried apply a dressing of oil and tallow; it must not be stiff dubbing; then set black. Next day, after setting out, give a dressing of oil and tallow. Hang up to dry, suspending the sides from tail to head on racks. When dry take down and put in pile. Harness should lie in stuffing two weeks or longer before being finished. When ready finish with a sharp slicker on flesh side, or use whiting slicker; trim off all ragged portions, slick off grain, go over on grain

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with a bristle brush, then with a woolen rag. After finishing assort leather for different classifications.

BRIDLE AND SADDLE LEATHER.

Hides intended for bridle leather should be selected from young, well grown hides, with as full a shoulder as possible, and not too coarse in shoulder or grain. They are preferable tanned in oak bark, though a good leather can be tanned in hemlock. Hides should be selected to weigh from 25 to 30 pounds tanned, dry weight.

The hides should be soaked in clean water, stoned in shoulder, either by hand or machine, then shaved two ways. First on the cross, then straight drawn, then scoured clean out of warm water on flesh and grain, either by hand or machine. Some firms mill them in borax water first, and pass them through a weak solution of sulphuric acid, then wash them out well with clean cold water.

MILLING WITH SUMAC.

The next process is the sumacking. Take about 2 pounds per hide best Palermo sumac, boil well for half an hour, with sufficient water to cover it well, then cool off with water to 120 degrees, so that one can bear the hand up to the elbow in it. Put the hides in the wheel with sufficient sumac liquor to cover them, and run for one hour. If no mill is at hand, handle the goods about three times in the day. Warm up to 120 degrees each time of handling, and cover up the top of the vat with boards to keep the heat in. After sumacking, slick them out on flesh side. Give them a coat of good cod oil on flesh and grain and hang up to sammy. When dry enough that the grain will stand out when set, they should be taken down and dampened with clean water, as regularly as possible. Then spread some good dubbing on the table evenly and set down to it. Take care that none comes on the grain, if hides are intended to be stained afterward. See that all slicker marks are taken out, rub grain out with flannel cloth with a little water, and hang up to dry. After hanging a short time, and while still damp, clean the table thoroughly free from grease, etc., and glass on flesh side and hang up again till the flesh side is dry enough that it will not stick to the table in resetting. Brush out on grain with clean water, reset with dull, clear slicker brush over again, then glass on grain to take brush marks out, and hang up to dry in an airy loft or tack out on boards.

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The English and German firms flat these leathers on the flesh side, after sumacking and oiling when they are sufficiently dry enough, and a little stiffer than for the first time setting. This requires a currier of experience to do the work satisfactorily, using a very clear low edge, taking a light, even stroke all over the side, and making a parting stroke about two and a half feet from the tail. This gives the leather a fine, close appearance on the flesh side. The setting is the same for these as for the others, with the exception that in dampening down for setting, do not rub the flesh at all, or it will be white, but pat it with your damping cloth, the object being to keep the flesh side brown and smooth. When goods are dry, take down and stain.

COLORING.

For a light brown stain take a weak solution (liquid extract) of Spanish annatto, or a very weak solution of leather yellow. For a good orange color take phosphine. It would be hard to give the exact quantities, as different tannages require different strength of color, which must be learned by experience. After staining over once, let the stain go in a little, then if a rolling machine is handy, roll on grain with medium pressure, then give another coat of stain and a light coat of tallow dubbing on grain. Run over it with ball of your arm or hand, and hang up a short time till the grease has struck in, then glass light and regular on grain and hang up to dry. When dry, take down and tallow the flesh side with some good tallow. The tallow should be scraped and kneaded with the hands before putting it upon the leather. Use a clean, dry sponge for this purpose, doing only a small space at a time, the object being to get as even color as possible on the flesh side. Lay them all flesh side up on the table and hold them with one hand, that they do not slip about on the table while you put the tallow on with the other hand. When all are tallowed, clean the table free from grease, etc., brush out well on grain and glass. When all are done on grain, brush and glass on flesh and wipe off with flannel and roll on both sides. They are now ready for the shipping room.

Hides intended for natural or self color should be set on table without grease first, brushed over with a weak solution of oxalic acid, about 2 ounces to a pail, then set down to grease on table and a light coat of dubbing given on grain side. Hang up a short time till the grease has gone in on flesh side, then glass well. Lay down, clean

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SORTING LEATHER.

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table, and glass on grain lightly, and hang up to dry. When dry, proceed to finish as above directed.

HARNESS LEATHER BLEACHING.

In bleaching there are various ways. The following method is in successful use by an experienced harness leather tanner and is for hemlock or oak leather tannage:

For a wheel that will run, say, twenty sides, take the sides rinsed from sumac. Put in the wheel the twenty sides, in a mixture composed of one pound of borax and one pound of Glauber salts, dissolved in four pails warm water, and run twenty minutes. If very light color is wanted, put back in the wheel with one and one-half pounds unrefined sugar of lead, dissolved in two pails of warm water; in twenty minutes run the water off, then put in two pails more warm water, with one part sulphuric acid; run twenty minutes. If only medium color is wanted, brush on scouring table, flesh and grain with the unrefined sugar of lead first, then the sulphuric acid. It may take two or three applications. This will also do for hemlock leather.

TANNING SKIRTING.

The following method for tanning, coloring and finishing skirting is recommended by a practical tanner:

Skirting should be well soaked in clear water, then well fleshed and if not thoroughly soaked replace in the water until soft. When well softened put on a board or table (flesh down) and wash wool thoroughly with a strong solution of soap and a little soda. When grease is well out and wool clean, rinse in clear warm water until perfectly clean. Then put in tan liquor and handle often in order that the alum may thoroughly permeate the skin. Do not rub the skins, but give them two or three days' time to tan. Increase the strength of the liquor once a day.

To prepare the liquor: Dissolve 30 pounds of alum in 50 gallons of water; then add 18 pounds of salt. Of this solution take 5 gallons to every 75 gallons of water and add one gallon every time the skins are handled. The tanner must see that the skins are under liquor and not packed too tight in the vat. When they are well tanned put them on a horse or buck and drain over night. Then take them to the drying room and pile them on a table (flesh side up) and give a thin

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coat of fat liquor, consisting of 3 pounds of dissolved soap and 1½ gallons of neatsfoot oil.

If the skirting should be white, hang in a close room, burn five to six pounds of sulphur and leave the skins to hang until dry. If colors are desired, color with aniline before fatliquoring. To color, the tanner must be a judge of shades. Dissolve the desired color in water and strain; put enough water in the color tub to cover six to twelve skins. To this add one pint of dissolved aniline and turn the skins forth and back. At the same time increase the strength of the color until the desired shade is obtained. Next rinse in water containing a few drops of sulphuric acid in order to make the color fast.

For seal brown, tan and dry in the manner already mentioned. Then take down and turn in a drum with gambier until the wool is colored. Afterwards fold in two (head and butt) and pass in a solution of bichromate of potash of 7 degrees and rinse in clear cold water. Repeat bichromate bath if dark brown is wanted and dry after draining.

The finishing is done by first dampening in pine wood dust, and spreading both length and width, then drying and cutting off all flesh on an emery wheel and staking both ways.

TO CURRY STAG LINE LEATHER.

Leather suitable for stag line russet or English finish should be split even. It is difficult to obtain a fine close finish on the neck of flesh side. To overcome this trouble, give the leather a good stiff case, when it will be ready to shave or flatten. Back shave, commencing at the head. Give a clean cut, shaving back to the hip; turn ends; shave from butt back to hip, meeting where left off, making a parting mark square across the side. Watch carefully and do not leave any trace of knife, except parting line at hip.

Now the side is ready to set out on table. Use harness grease on the flesh side. To stick to the table set the side out well on grain free from dubbing. Oil the grain side with good cod oil. Hang up to dry. When half dry, take the side down, turn flesh side up on table. Use a round edge hand glass, and glass down flesh solid and smooth. Do not drag glass back over the work. Hang up to dry.

If russet line leather is wanted, dampen grain side and spread grease on grain even and thin. Take your arm or dummy and smooth the

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grease even over the grain. Hang up to dry. When dry stick flesh side very lightly, and glass with round glass. Finish grain with a dull set and soft brush. If English finish is wanted, buff the grain off and clear from scratches. Dampen grain with clean water, grease grain very lightly, and set out on grain with set. Grease again. For finish, smooth down very lightly with arm or dummy. When dry, stick grain with dull set, brush with soft brush, and wipe off with woolen rag. Follow the above instructions, and you will avoid Napa flesh stag line leather.

The best grease for finishing grain is composed as follows: Fifty pounds of tallow, 40 pounds of cod oil, 5 pounds of paraffine wax.

Heat and mix together. When the grease is cold, to every ten pounds of grease use one pint of cold water. Mix the water in the grease until the grease becomes white. It is then ready for use.

MANUFACTURE OF HARNESS LEATHER WITH EXTRACT.

Very few tanners are at present using bark alone. They find that it is greatly to their advantage to use an extract of bark for the purpose of building up their liquors. These extracts have been made in the United States for more than twenty years and their value to the tanner is continually increasing. Many of the leading tanners are using extracts entirely. It is evident from this fact that fluid tannin is of considerable value to the tanner, and it is readily conceded that by its use the manufacturer obtains better results.

It must be admitted that tanners do not always meet with success in using extracts, owing to errors which they commit in its utilization. There are many details which must be taken into careful consideration.

The first point to be considered is the kind of extract most suitable for a special process of tannage.

In reference to harness leather, both wood and bark extract have been used in tanning this kind of stock. After several years' experience it is now an unquestionable fact that the bark extract makes the toughest and the plumpest leather.

On the other hand, wood extract is much better for the tannage of sole leather.

Chemical analysis shows that the tannic acid in wood is absolutely different from that in bark. Both extracts have their particular uses,

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but produce opposite results. The wood fluid is the thinner of the two. It penetrates the hide very quickly and will give a fine, white bloom to the leather after the pack is laid away for a time.

All sole leather tanners who require a heavy bloom on their leather use wood extract for this purpose.

ESSENTIAL REQUIREMENTS.

The main object in the manufacture of harness leather is to produce firm, plump stock that possesses great textile strength and a grain which will not pipe or crack.

This is a difficult point to obtain, for the reason that if heavy leather is tanned sufficiently to make it solid and plump, it is very liable to crack upon the grain. On the other hand, if the hide is not well filled in the yard (while it is tough and does not crack), when it is finished it will have a raw appearance, and the shoulders and flanks will be poor and flabby.

Tanners generally endeavor to strike the happy medium, but how often does it happen that they get poor leather out of a No. 1 pack of hides?

While the condition of the hide itself is often responsible for this, it frequently happens that the tanner is to blame through neglecting to attend properly to the details in the early stages of the tanning process, and permitting carelessness in the beamhouse.

DECEPTIVE BARK LIQUORS.

Another important reason why stock does not run uniform in a great many tanneries arises from the failure of the tanner to thoroughly understand the commercial value of the liquors which he has in his yard, and the actual losses he sustains in making and using them. There was a time when the margin of profit in manufacture was sufficiently wide to cover small losses, without being apparently noticed, and when harness leather always found a ready sale. To-day, however, everything has changed, and it is necessary to closely figure expenses at every stage in the process of manufacture.

The only means at hand for obtaining the true value of tanning liquors are still crude in the extreme. One method which is employed as a sure test is to taste the liquor. Now, all that can be demonstrated by this is to discover whether the liquor is weak or strong, and it gives about as much information of value as could be obtained by just looking at it.

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Another test employed in more recent years is that of the barkometer. This is about as deceptive as the other one.

Take, for instance, a fresh bark liquor from the leach, and say that it weighs 15 per cent. to 20 per cent. Bkr. Then take the same quantity of liquor from the oldest and weakest handler and it will probably weigh within 1 or 2 degrees as much as the fresh liquor. This proves that by taking the density of a liquor it cannot be expected to correctly ascertain its actual value as a tanning agent, and the tanner is left completely in the dark until the end of the year, when he makes a guess at the value of his liquors.

Many tests have been recently made by taking different grades of bark, and, after leaching them, comparing the strength of the liquors.

It has been found that a poor, inferior bark produced a liquor within 1 or 2 degrees of that made from bark of the first quality. The result was so astonishing that several samples were secured and sent to a well-known chemist for analysis.

The subsequent report showed that while the value of the liquor from the prime bark was good, the other liquor from the inferior bark was practically worthless. Yet they were both fresh liquors and, according to the barkometer, almost equal in value.

Now, the tanners who use extract exclusively are in a much better position. They have this tanning material already prepared for them without any trouble or expense, and every barrel can be easily analyzed. This, of course, is not necessary, as the extract does not vary in strength like the natural bark liquor. A 42 per cent. Twaddle extract averages from 26 to 28 per cent. tannic acid, and if samples are taken from two or three barrels and mixed together, it will give a very correct estimate of the value of a whole carload. By this means the tanner knows exactly what he is putting into his vats, which considerably lessens the danger of turning out poor stock.

Many tanners are not familiar with the most practical methods of using extract, and consequently do not realize the best value from it. The writer is thoroughly posted on the system employed by the largest tanners, who use extract entirely, and will explain how it can be used to advantage without the aid of bark liquor made in the yard.

TANNING WITH EXTRACT.

After the hides leave the beamhouse they are suspended in the oldest and weakest liquor in the handlers. The best way to suspend

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them is to fasten the sides from the butt ends on the sticks, and let the hides hang down straight, this makes a plumper and firmer shoulder and does not cause any creases on the grain. The prevailing opinion seems to be that a good handler liquor cannot be made from extract alone. This is a great mistake. If the liquor is allowed to circulate around a set of, say, eight or ten handler vats, by the time it reaches the vat which receives the green pack from the beamhouse it will be in fine condition and will prepare the hide for the stronger liquors much better than an old sour bark liquor.

Pure extract liquors do not sour very readily, and according to chemical analysis and practical experience this is an advantage. There is a great difference between a sour liquor and an old liquor charged with acetic acid. The former does more harm than good and makes the grain brittle. Tanners have always imagined that they must have an old sour liquor to plump the hides, but this was because they knew of nothing better.

An old extract liquor has just enough acetic acid to plump the hide without injuring it, and as the liquors circulate around and the pack gets into a stronger liquor each day, in four or five days the hides reach liquors in a stage of lactic acid.

It is at this period that a great change will be noticed in the appearance of the hides. They begin to swell up perceptibly and the tannic acid penetrates the hide very rapidly. For the remaining three days the pack remains in this set of handlers. The head vat should be kept at about 12 per cent. and freshened up twice daily. The liquor for these handlers should be taken from the next set of eight handlers that the hides are to be suspended in. After remaining in the first handlers for eight days the pack is transferred to the second set. The head or oldest vat should have a 17 per cent. liquor and by circulating around it will regulate itself in the other vats. If possible, always have eight vats to a set, but never more, otherwise the liquors will not regulate themselves properly. After the hides come out of the second set they will have been tanning for sixteen days, and are ready to be laid away.

The hides are next taken off the sticks and thrown into a 21 degree liquor. To obtain this liquor take the same from a vat that has had a second layer, and add fresh extract until it is the required strength. Never place fresh liquors with the handlers, as there is always sufficient liquor from the first layers for this purpose.

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When the hides are immersed in this 21 degrees liquor, bark or something of that nature should be sprinkled between them. If bark is used sufficient should be taken to cover the hides, but the liquor must be depended upon to effect the tanning. The pack should remain in this liquor about the duration of a week. At the end of this period the hides will be well struck in, and should be submitted to the action of a liquor of 23 degrees.

The liquor should be taken from the next oldest layer and strengthened with fresh extract. At the end of two weeks the pack has been in the yard for thirty-seven days. The hides are then in a condition to receive a 25 degree liquor, and if there is not sufficient old liquor, water can be used to mix with the extract. The hides should remain in this layer for about three weeks, thus making about fifty-eight days in all. After that they will be struck through and should be laid away again in a 25 degree extract liquor until required.

When making this last liquor use only water with extract, and if this rule is followed out it will always give a sufficient quantity of liquor for the younger packs, which can be strengthened up with extract.

Every tannery that uses extract should have a large vat or tub to mix the extract in. The inside should contain revolving paddles, which should be run for fifteen or twenty minutes.

In very cold weather the liquor or water should be heated, thus causing the extract to dissolve easily.

TO PREVENT HARNESS LEATHER FROM CRACKING.

Many experienced tanners and curriers claim that buffing harness leather is a complete and unnecessary loss.

Now I am certain and shall endeavor to prove that such is far from being the case.

Every manufacturer has had his trouble with leather that cracked and broke open after being finished, and I know of one who abandoned the business for the above reason.

The cause of cracking is often thought to come from the beam-house, or handle house, which is often the case; from using old liquors, or not keeping the vats clean, or in not using fresh lime as often as should be, to prevent the grain from becoming brittle and harsh.

Many manufacturers make experiments and cause themselves no end of trouble and expense, but the vexation does not cease.

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Therefore, I claim that buffing, when performed by a skillful workman, is the best and most practical method.

After the leather has been well set, dried, and pressed out "in the pile," it should be dampened slightly with warm water.

Then it should be buffed lengthwise, from head to tail (never crosswise). The flanks and shanks should not be buffed. Too much cannot be said in regard to the workman who performs this work. He must understand how to keep a perfect edge, in fact it may be well to add, he must use what is known to the trade as a "top edge," and great care should be used to not buff too deep, but split the grain.

After this operation, the leather will naturally take more grease, and will have more elasticity, which is so much sought by all manufacturers of leather; and above all, it will not crack.

HINTS TO HARNESS TANNERS.

Fleshing is very important and particular work. Hides should be fleshed perfectly clean, except the flanks—that is, for all leather that is to be skived or shaved. It takes a mechanic to keep his flesher in order, that the hide be fleshed clean and no leather cut away.

A good flesher can flesh from twenty to twenty-five hides per day, and for heavy harness hide fleshing ought to get 8 cents per hide, but we find that in the majority of cases the pay is from 5 cents to 6 cents per hide, and I have it from very good authority that they flesh from forty to fifty hides per day.

How is that done? It is done by forcing and slighting work, for it is impossible to flesh forty-five heavy hides in ten hours, and I am told some do it in eight or nine hours, and by such fleshing there is many a dollar lying under the beam!

MACHINE OR HAND FLESHING.

Machine fleshing takes off the grease, but in the soft parts the machine goes too deep; it slides over the butt and presses the hides together; if on the edge there is any sticky place it is caught between the rollers and is burned. The friction and the pressing the hide has to go through is very plainly discernible. It looks as if it had been tacked on frames.

I do not condemn machinery, for machines will not go on a strike. They are ready for work every Monday.

The question is, Which is the more profitable for the tanner? Take

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a beamhouse that works 600 hides per week, part harness, part collar and part lace, about half green and half dry hides. Green hides of from 25 to 55 pounds and dry hides 10 to 24 pounds. The glue stock averages $55 per week. By machine fleshing you will not have one-quarter of this amount, except that you have plenty of torn shanks and heads. Tan all this flesh, and when partly tanned skive or shave it off, and you will find that the places where this flesh has been pressed in are perfectly raw.

To tan the flesh will cost about 6 cents at the present price of bark and extract of quebracho. The shavings have to be burned in a furnace, when the fleshings will pay three-quarters of the beamhouse expenses.

BATING.

Bating is a matter of opinion among tanners. Water is to be considered, but I would rather have clean pigeon manure than anything else, if properly used and wheeled in the bate. The hides in one hour's bating can be ready for working. Then the hides are well stoned and rubbed or ground perfectly square. First go over them lightly, so as to get the roughness out. Then work them hard, throw them in clean water and work with a sharp, close worker, the same as with stoning, except that you should go easy on the flanks so as not to stretch them too much. Now throw into clean water, and the hides are ready for the handlers.

TANNING.

Hides handled in this way can be started with 8 or 10 degrees liquor, strengthening it regularly until the hides are ready to go into the layaway vats. Such leather thus treated should have about 20 to 25 degrees of liquor and sufficient bark between the sides, so that they have nourishment and are not pressed too closely together.

Leather may be skived out of a second or third layer, and liquor may be somewhat stronger. The tanner must use judgment in this matter. Leather carefully handled all through can be tanned in sixty-five to ninety days. Scour the leather before it is dried out, as leather dried out perfectly will not take the grease and look as well as leather that has not been dried.

STUFFING.

Finished leather should be carefully dampened and left piled up for two days, and so well covered up that none of the edges will dry

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out. Then warm the mill and give the leather from 5 to 8 pounds of stuffing per side and set out by hand or machine. The leather will work all right.

UNWISE ECONOMY.

Test the leather when dry, and I will guarantee it will not crack or tear and will have a fine grain and good color on the flesh. So very little for beamhouse work is being paid that a good beam hand cannot make a living if he does the work right; so in order to make both ends meet he slights the work.

Then the tanners use putrid, sour liquors for handlers. Some tanners say that this will draw out all the lime and other impurities in the pores, but this will not compensate for poor work in the beamhouse.

THE LAYAWAYS.

After being properly handled for from fifteen to twenty days the hides are transferred to the layaway vats, eight by nine by seven feet deep. Two packs (fifty hides each) have to go in this vat. Tanners call it "doubling up." The vat is filled but half full of liquor, then the hides are thrown in and a little bark is thrown between each, but not enough to keep them from lying and pressing so severely together that hardly any liquor is between them. They lie in there like a brick wall, for there is in that vat about 4,000 or 5,000 pounds. Divide the liquor into 100 parts and see what comes to each hide. The pack is turned three or four times until tanned. Sometimes as high as 40 degrees liquor is given in the last layer.

STUFFING.

When ready to finish the leather is so hard and humpy that it has to be put in a wheel before it can be scoured or skived. It looks thick and plump, and after it comes up stairs it falls back. We find that half of it is grain. After scouring hang up, as some tanners dry out. Now it is either wheel stuffed or dipped. This latter will not take the grease so naturally, and it has to be forced by wheel stuffing, and the leather hung in a room close to where the wheel is located. This room is heated up to about 130 or 135 degrees; then take the leather and throw it quickly into the mill. The mill is up to about 125 or 130 degrees. Pour in the grease and mill until absorbed into the leather. Now put under a machine and set out, and it is surprising the grease the machine presses out.

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DIPPING.

Now, in regard to the leather that is dipped. When leather is dried it is hung in a room heated to about 140 or 150, and then, while the leather is still warm, dipped into hot stearine and tallow. Dip it until it will take no more; then it is thrown into hot sumac over night, and next morning put into a mill and milled. After an hour or an hour and a half set with machine and also by hand. In order to get it down on the table it is sometimes necessary to cut out pieces. In some shops they allow one man to cut 8 pounds per day from about twenty to twenty-five sides, and leather is dried for the blackers.

We test leather on the grain and find it opens or cracks. We try it on the back, say by cutting a quarter of an inch; it breaks and tears. The edges have to be trimmed off from one-half to one inch. The leather has to be buffed all over; some is so hard and crusty that it may be needful to brush hot water over it. Otherwise the slicker slides off as if it were glass.

We weigh the buffings and find that we have from 5 to 7 ounces per side. At 600 sides per week, 252 pounds at 25 cents per pound making $65.66, and two men buffing this take $24, total $89.50. After the leather is blacked, then grain finish is applied and glassed, and it looks very nice. What has nature made the grain for? The grain is on the side of leather like the enamel on the cloth—to keep water from penetrating when made into harness.

MANUFACTURE OF SEATING LEATHER.

Hides selected for the above purpose should be free from cuts and grubs. After the leather is selected at the belt knife machine, it is taken back to the yard to be retanned, as follows:

RETANNING.

Make a solution of gambier by putting 125 pounds into 40 gallons of water. Heat and dissolve. The strength should be about 12 degrees. Allow about 12 gallons—enough to cover fifty sides. Put sides in the mill and run it for one-half hour. Then remove, and pile up over night. Next day put them in a 12 degree liquor either hemlock or oak. Leave them there until tanned. Then remove and have the sides well washed with water in the wash wheel, for from ten to fifteen minutes.

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MILLING.

Put 12 pounds borax into 50 gallons of water. Cook until dissolved. Put leather in the mill with the borax water, which should be about 90 degrees warm. Keep plugs in. Mill half an hour. Run off borax water. Then prepare a mixture of sulphuric acid and water, making it about 10 degrees of strength by the barkometer.

Let mill run ten minutes, then withdraw the leather and wash off in cold water. The sides should now be taken to the paddle wheel for a sumac bath. This is made by putting four common pails of sumac into 50 gallons of water, which should be heated to 100 degrees.

The leather should be kept in the vat under the paddle wheel for three hours, then remove and scour well on both sides and sammy in the usual way. It should not be too wet, so as water will ooze out a trifle.

SETTING.

When ready for setting, set on grain side first, then on flesh side. Give leather a coat of a mixture of one-quarter paraffine oil and three-quarters cod oil. Leave in pile until the oil absorbs. Then set well by hand and oil again on backs. Oil heavily if needed, then stretch the sides and tack them on boards to set. Drying should be done in fifteen hours.

When dry, take down and trim. Then prepare the following: Cook 1 pound of Irish moss in 3 gallons of water. Add 4 ounces of chipped soap. Cook all together, strain and give the leather a liberal dose on flesh side, which will fill up and give smooth leather. Then run them in a wet state through the jack, or better still, roll them by the jack and then hang up.

When dry, remove, trim and black with the following mixture: To 25 gallons of logwood water (use 20 pounds of logwood) and 1 quart of ammonia, add 3 pounds of fustic. Use Stevens' copperas water, which is made as follows: Nine pounds copperas, 4 ounces nutgalls, 3 ounces acetic acid, all mixed together in 50 gallons of water.

When the leather is pretty nearly dry, smut well, and let it lie over night.

Next morning, use scar paste, made as follows: Dissolve 1 pound of gelatine in 2 gallons of strong staining logwood. Cook well and add ¼ ounce of bichromate of potash, and 4 ounces of nigrosine. Cover scars well, roll and hang up over night.

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FINISHING.

Next day, prepare the following finish: Cook 10 pounds of chip logwood in 9 gallons of water and 1 ounce of salsoda. Cook one hour. Then add 1 ounce of bichromate of potash and 2 ounces of prussiate of potash. The last two materials should be dissolved separately each in a quart of hot water, and added hot to the logwood solution, and left to cool over night.

If a deeper black is needed, add 6 ounces of fast black or 6 ounces of nigrosine to the dressing. When this solution is cold, put 4 pounds of albumen in 4 pounds of water; dissolve over night and add this to the finish just mentioned above. There should also be put in 1 quart of ammonia and 1 pound of glycerine. Should this finish fail to polish, use 1 quart of sweet milk, combined with 3 gallons of dressing. Give the leather three coats of dressing, dry well and polish to suit your trade. For dull finish, one coat is enough.

Some curriers like to oil off as a kind of wind-up. The following preparation will, therefore, be found useful: Use proportions of 1 quart paraffine oil with three-quarters cod oil. Should you fail to get a deep black your staining must have not been right. Good staining is more than half the battle. One pound logwood to 1 gallon of water will make a jet black.

ROUGH GRAIN ON HARNESS LEATHER.

The difficulty of rough grain on harness leather can be overcome by tacking the sides on slats that fit inside the vats lengthwise. Nail a strip on each end of the vat on which the slats can rest so that they will be kept covered by the liquor. If the vats are not long enough for hanging the sides full length, suspend them on sticks placed crosswise. The sticks should be about one inch square with two edges rounded off so as not to mark the sides. They should also be turned over once a day for the first three or four days, thus shifting the position of the sides. This will keep the color even on the grain which is on the outside with the flesh against the stick.

Liquor for the green sides should be about 2 degrees barkometer the first day; about 3 degrees the second day, and so on until about 6 degrees are reached in eight days. The sides should be moved about twice a day during the first two days so as to assure even color, as they are liable, at first, to stick together. They can be left on the

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hangers for from eight days to two weeks without being injured, but must hang long enough for the grain to be tanned through or it will raise again and become hard and difficult to manage when you begin to handle the stock.

After removing from the hangers the leather should be milled in a drum wheel for twenty or thirty minutes. This will soften the stock and hasten the tanning considerably without any danger of weakening the strength of the leather.

By following these instructions a fine, smooth grain will be obtained and leather that will do for the finest harness work and be strong and durable in every way.

PREVENTION OF SCUM AND PIMPLES ON HARNESS LEATHER.

There are harness and saddlery leather tanners who have considerable trouble with their stock. White scum or pimples are very disagreeable when they appear. The scum difficulty is always worse in damp or cool seasons than in the hot or dry weather, while the pimples are generally worse in hot weather. This goes to show that the amount of ventilation through the drying lofts in damp or cool weather is not sufficient to allow the moisture to escape as fast as it comes out of the leather, while in summer time the windows are open and the air circulates freely through the stock, and carries away the moisture as soon as it comes from the stock. This gives the white scum no chance to appear unless the leather is dry. Sufficient ventilation is as necessary as heat in damp weather.

The pimples in mill stuffed leather can be prevented by doing away with the use of oil in the stuffing wheel and not dampening the leather quite so much as when oil is used. The manager should see that the leather is thoroughly scoured on both sides and thoroughly dried and laid in a pile for a few days before damping for mill stuffing. Harness leather to be mill stuffed should be damped and laid in a pile and covered for about twenty-four hours before stuffing. Pure tallow stearine and paraffine wax used in proper proportions make a good clean stuffing that is not apt to cause any trouble when put into the stock.

The leather should be well set on both sides and reset and dried out thoroughly before blacking. When the stock is ready for blacking the logwood for a full day's work should be made up fresh every morning

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and the amount of soda, or whatever is used to cut the grease, should be put in at one time and no more added to it. The logwood should be made up in a jacketed kettle or tank with a coil of steam pipes in it so that the live steam does not reduce the strength of the logwood. The black for mill stuffed harness leather should be made extra strong. After the stock is blacked it should get a coat of best tallow and oil in about equal parts on the grain side and be laid in a pile over night and covered so as not to dry out. This will cause the surface to be soft and in a good condition for black setting. This should be done with a thick steel slicker and glassed over. After this give the grain a coat of hot tallow, then dry it out thoroughly before taking it down to whiten or wash on the flesh side. If the leather is washed it should be hung up right from the washer's table, so as not to allow the moisture to penetrate the tallow on the grain and the leather should be dried out as quickly as possible.

By this system there is no chance for scum or pimples to appear on the leather. One of the largest harness leather tanners in the United States adopted this treatment about eight years ago and has not seen one side with either scum or pimples on it since and I think it will be a benefit to others to try the same system.

CAUSE OF HARNESS LEATHER CRACKING ON THE FLESH.

The tanner wheel-stuffed his leather, and he tanned it, as every wheel-stuffer is forced to do, slimly. As soon as his stock was struck he took it out of the liquors, and, as every tanner knows, slimly tanned stock is not apt to crack, either on the grain or on the flesh.

The cause of the leather cracking on the flesh was traced, not altogether satisfactorily, to the too free use of a certain bleach—muriate of tin.

The muriate of tin was manufactured by the tanner. A quantity of block tin was melted in a crucible and poured from a height of three feet into a pail or tub containing cold water, when the sudden violence of the contact caused the tin to break at once into small pieces. The shivered tin was put into a 45-gallon oak cask and a carboy of muriatic acid poured over it. As soon as the acid had dissolved the tin the cask was filled up with clean water, when the solution was ready for use. For bleaching, a small quantity of the solution was added to a pail of water.

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The tanner, when stuffing his stock, gave each side 3 pounds and 8 ounces of tallow, 24 ounces of resin, 24 ounces glucose, 24 ounces barytes and 1 pound of white wax. The tallow, resin and white wax were melted in a steam jacket-kettle. The proper quantity of the mixture for a batch of sides was ladled from the kettle into a suitable vessel, when the glucose and barytes were added, and the whole well stirred until the glucose was dissolved and the barytes thoroughly mingled with the other ingredients, then the mixture was poured into the stuffing wheel before the barytes began to settle at the bottom of the vessel.

It is a well known fact that glucose causes leather to crack. Twenty-four ounces of glucose to a side is not proportioning it properly to a side, for experiment has demonstrated that 8 ounces a side cannot be exceeded with impunity.

It is not improbable that both the bleach and the glucose were the cause of the leather cracking, the glucose mainly so on account of the large quantity used. We have seen fair bridle bleached with a strong solution of tin, yet no bad effects were immediately apparent; but time developed them more or less, not, it is true, in so great a degree as it does after the use of glucose.

MILL STUFFING HARNESS LEATHER.

(1) Having got your leather in a good sammied condition, prepare your mill by heating to about 130 degrees F. Then shut off heat, and put in your leather and start mill. After it has made a few revolutions, enter the grease and run for fifteen to twenty minutes, then stop mill and take off the door and run again for five minutes to cool, when it is fit to take out and stuff with a light coat of dubbing.

(2) Grease should be prepared in jacket kettle, and enter mill at about 125 degrees F. Add to tallow 2 per cent. moellon degras and from 10 to 25 per cent. stearine, according to weight of leather and season of year; the warmer the weather the more stearine.

TANNING AND CURRYING REIN LEATHER.

In tanning hides for harness there are always some spready bulls or steers left over, and the most profitable way to utilize them is to make them into rein or line leather.

Select those that are light down the back, skive and then level the

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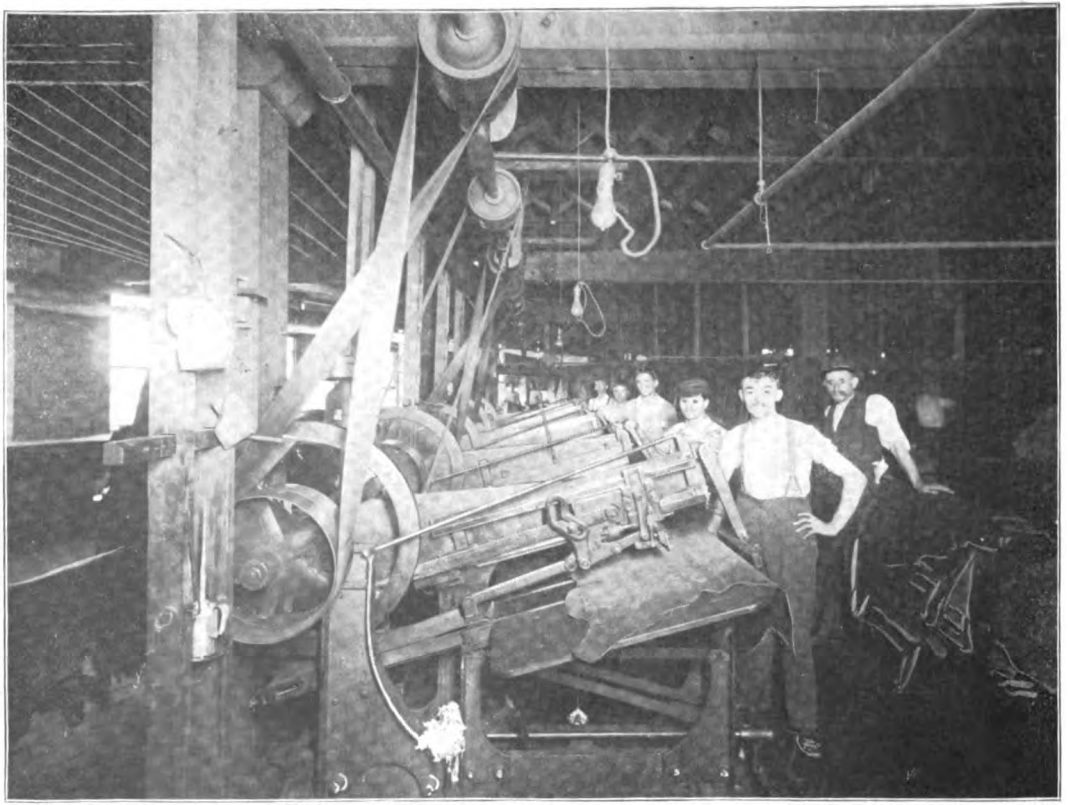

THE FINISHING ROOM.

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bellies and heads in splitting machines, not quite down the back, as the soft belly will go down in setting. After splitting, scour well on flesh and grain, then dip two or three times in good, warm sumac liquor, and let rest in sumac all night. In the morning take out, rinse well on flesh in clean water, then scour well on grain. After thoroughly oiling both sides with mixture of half cod and neatsfoot oil, hang up to sammy. When in good shape take down, dampen the dry spots, then stone out on grain, to get all wrinkles out. Flat them over with a low currier's edge, leaving no corners, sets or scratches.

In getting ready for stuffing a great deal depends on the dubbing, which ought to consist largely of cod or neatsfoot. To stiffen, use good cake tallow in making dubbing. To stuff to best advantage put the side on grain up. If more weight is wanted, turn over, lay the flesh down with round glass, and stuff as heavy as wanted.

RESETTING.

When in good shape, take down, match, and press so they will lay flat on the table. Dampen, set well on grain, give a good coat of fish oil and glass well on flesh, with round glass. Hang up when stuffed on flesh; only reset on grain.

FINISHING.

After blacking give grain side a good coat of warm stuffing composed of cod oil, neatsfoot and tallow. Let them lie a few hours, then set on grain, glassing them well, after glassing put on some hot stuffing, as lightly as possible, with flannel cloth; then hang up. In finishing, the sides stuffed on flesh must be cleaned off with setting glass so as not to raise the flesh. Those that are set to table can be glassed down on flesh after a very light coat of cold tallow. In this way of finishing, the grain only wants brushing up, and wiping with flannel cloth.

BUFFING.

When buffed on grain a good scar paste can be made by taking one pound of common glue; two ounces Venice turpentine; two ounces unrefined sugar of lead, dissolved in three quarts of strong logwood water, this to be applied after blacking.

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CLASSIFYING AND GRADING OF HARNESS LEATHER.

1. Harness leather is divided into three grades: No. 1 leather must be free from any blemish on either grain or flesh, and must run good substance in the shoulder. B leather may contain slight imperfections, on either grain or flesh, such as small horn scratches or slight scores, or a side fairly free from imperfections, but of poor shape. During the season when grubby hides are being furnished a B side sometimes contains one or two grubs if the side is otherwise free from imperfections. No. 2 leather embraces sides bearing several horn scratches, leather scored on the flesh, and grubby sides.

Leather too poor to be classed as No. 2 by reason of being very grubby, badly hacked, or bearing both middle and butt brands, usually constitutes a fourth selection.

2. It is difficult to keep track of all that has been said or done in regard to quick tanning processes. Leather can undoubtedly be made in a very short time, but the quality of all such leather thus far has proved inferior to leather tanned by slower but more sure methods. Electricity has been employed in tanning processes, but has not proved successful enough to warrant its continued use. Leather making is a comparatively simple process. Light skins can be put through very rapidly, the main object being to obtain suppleness and tenacity. With such heavy leathers as harness, sole and belting, it takes time for the hide fibers to be so firmly and strongly interlaced by the action of the tannic acids of the bark that undue haste produces inferior leather. The tanning of a hide is something like the education of a child, and undue forcing is followed by regret. There are methods of quick tanning with wheels, but so far all these attractive schemes fail to maintain their popularity. At the same time it must be admitted that modern tanners, by studying their business carefully, may curtail the beamhouse work, and push the stock through the sour and sweet liquors with less leisure than their forefathers did and yet achieve good results.

The good and bad leathers often look alike in appearance, but hides that have not been properly treated will not make leather that will stand hard usage, like a hide that has taken time to tan properly. Many fortunes have been lost by tanners who jumped too quickly at conclusions. Tanners certainly should be wide awake and progressive, and willing to look into everything that promises to advance their prosperity. But every quick tanning process should be carefully tested by them in their own plants, provided it successfully passes a preliminary

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theoretic study or examination. Each tanner should be his own judge. We are living in days of surprises of all kinds, but this is all the more reason why we should be alert all the time to distinguish true from false progress.

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Glove Leathers.

MANUFACTURE OF GLOVE LEATHER.

There are two qualities that glove leather must possess. These are softness and strength. This leather must be very soft and elastic; the grain must be smooth, soft and strong and the color deep and uniform and free from spots and streaks. In order to get all these qualities in the leather the skins must be handled right from the start. To get the softness and elasticity the skins require a long and thorough liming and a very thorough drenching or washing before tanning and after tanning they are given more fat liquor than skins intended for shoe leather. For removing the hair and wool from skins, sulphide of sodium is largely used, usually in conjunction with the lime, when an extra fine leather is not required. But when leather of very fine grain and texture is wanted the use of red arsenic mixed with lime gives smoother and more elastic skins, with a finer grain. Its use readily removes the hair, also the fine hairs, and leaves the skins with considerable body and fullness and of fine texture. Limes that have been used before are good to use, but they should be kept freshened up and clean, by frequent cleaning out and the addition of new lime.

Dirty limes are injurious to fine shades of color, as are also dirty soaks. Salted calf and sheep skins require but a few hours' soaking in warm weather and from twelve to twenty-four in cold weather.

LIMING.

Sheepskins should be thoroughly and well drained or the water extracted from them before being painted. A point that is sometimes overlooked is that it is just as important that a clean surface be presented to the limes as to the tanning liquors. Soft water is better than hard water, and when the water is known to be hard it can be greatly improved by adding to it a small quantity of borax, say 3 pounds to each 1,000 gallons of water. The liming usually requires from six

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to ten days, and considerable lime is used. Too strong limes used at first make the grain coarse and loose from the flesh, especially when red arsenic is mixed with the lime.

To the careless way in which skins are soaked and limed may be traced many of the serious defects met with on light leathers, such as shaded grain, difficulty in getting the tanning liquors to strike through and dry, hard spots in the leather.

When there is not a great deal of vat room, after the skins have been limed for a number of days they may be removed and placed in piles to feed for a few days. This gives good, soft, plump stock, but it is important that the grain be kept from drying and the skins kept from the air as much as possible. If high limed stock is wanted the skins may remain longer in the limes and more lime may be used. A paddle vat is very useful for liming purposes, as the skins are kept in motion and are consequently limed in less time than when still limes are used.

Skins cannot remain in a lime and sulphide of sodium solution for the length of time required to produce the necessary softness and elasticity of glove leather without more or less injury being done to the texture of the leather, consequently red arsenic and lime are better for the purpose.

The hair should come off readily, and when difficulty is met with in removing it the skins should be returned to the limes for a day or two longer in order to avoid straining the grain, which would show in colored leather.

UNHAIRING AND DRENCHING.

The best results are gotten when the unhairing and the fine hairing are done by hand, although many machines are being used for this work. After all the fine hairs are removed the skins should be placed in a tub of warm water for a few hours before going into the bath or drench.

The more thoroughly the skins are reduced in the drenches the softer will be the leather. It is absolutely necessary that all lime be gotten rid of. Calfskins are very tender and require careful handling during this part of the work, while sheepskins are not easily injured and will stand a very thorough washing. For these skins the bran drench is largely used. It gives the skins a nice, smooth grain. Manures also do this, but they are somewhat risky to handle. When the bran drench is used, considerable care must be taken that the drench

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is perfectly developed before the skins are put in. The grain is easily damaged by an undeveloped drench and many otherwise good skins are injured in this way. Before the skins are put into the drench they should be washed as much as possible, in order to remove much of the lime. Less drenching will then be required. To get the skins in such condition as to take the tannage readily, as well as to prevent the contraction of the fibers and to preserve the skins, and finally to work into soft and pliable leather, the skins are generally pickled in a mixture of sulphuric acid and salt. This pickling also acts as a bleach and also neutralizes any remaining lime. It is important that the skins be thoroughly pickled. They should be given plenty of time both during pickling and after they have been removed and horsed up to drain.

If the skins are received by the tanner in pickled condition they require a thorough drumming in salt water in order to soften them, after which the pickle should be removed by the use of whiting, which acts as a drench.

After the skins have been milled in salt water they are placed in a drum containing a solution of five pounds of salt and two pounds of bolted whiting for each one hundred pounds of skins, in water enough to cover the skins, at a temperature of 90 degrees. The skins are run in this liquor for thirty minutes and are then allowed to stand for the same length of time. A few ounces of salsoda may be added and the skins may also be drenched in a vat. After this drenching the skins are given a washing in a sour bran drench, by which the alkali of the whiting is neutralized.

ONE AND TWO BATH PROCESSES.

When the one-bath process of chrome tanning is used the skins are generally given a salt and alum tannage before the chrome liquor. Flour is sometimes used with the salt and alum, as it gives the grain a smooth, silky feel, besides filling the leather and preventing it from breaking up coarse.

When the two-bath process is used it is just as important that the pickle be removed before tanning as when the one-bath process is used. It is sometimes thought that as the skins are full of acid no acid need be added to the first bath, the skins being entered at once into the solution of bichromate of potash. This has been proven to be a wrong theory, as experience has shown that the best results are

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gotten when the skins are free from acid and the process applied in the regular manner. A good rule to follow is to sort the skins according to weight into three classes, light, medium and heavy; and tan each class by itself. It is customary to remove as much of the animal grease as possible before tanning. This is usually done after liming by subjecting the skins to great pressure. Wringing is sometimes resorted to and a naphtha process is sometimes used.

Calfskins, being very tender, are often slightly contracted during tanning. The drawing of the grain is not considered objectionable on glove leather. It usually requires three gallons of chrome liquor for each 100 pounds of skins in either drum or vat tanning. The vat method is cheaper than the drum method, as the liquor can be used over and over until completely exhausted. Prolonged drumming should be avoided, as it has a tendency to make the sides and flanks loose and open. In the two-bath method bisulphate of soda is sometimes used in the same manner and in place of hyposulphite of soda. No acid is needed with it, as the bisulphate is charged with acid to begin with. This material makes the skin a very smooth and elastic grain.

NEUTRALIZING.

In order to get the colors right the skins must be perfectly neutral—that is, free from acid and salts. For this washing drums or paddles are used. Borax is used to quite an extent for this purpose; it not only removes the acids but leaves the skins soft and smooth and thus in a better condition for coloring.

After the borax washing the skins are washed for one hour in clear water and are then pressed and all surplus water removed from them.

When acid is left in the leather the effect is to work upon the alkaline fat liquor and causing a mouldy appearance of the leather.

Glove leather that is soft and elastic when finished and gradually becomes hard and papery is the result of improper methods of liming the skins as well as by the presence of acids in the leather. The grain becomes weak and cracks readily and the strength of the fibers is gone.

More fat liquor is required by glove leather than by shoe leather, and the fat liquor should be thoroughly drummed into the leather before it is dried out. A mixture of flour and water is sometimes

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added to the fat liquor. This gives fullness and plumpness to the leather.

TO FIREPROOF YELLOW GLOVE LEATHER.

Cook 7 pounds olive chip soap and 7 pounds fig soap in 25 gallons of water. Add one pound powdered borax and cook until cut, then let cool down to 120 degrees and add 6 gallons egg yolk. If the egg is put in too warm it will spoil. Let the temperature drop a little below 120 degrees. Fill barrel with cold water to make 50 gallons all together. This is good for 65 to 70 horse sides, kips or cow sides. The leather ought to be run for one hour in stuffing mill, which should be kept at 120 degrees. After this treatment the leather when dried will buff nicely on buck-tail emery. As a rule tanners take from 600 to 650 pounds of pickled stock to ton, and when tanned this makes one mill full.

GLOVE LEATHER FROM DEERSKINS AND HORSEHIDES.

Deerskins are naturally very soft and spongy, and when properly tanned they make excellent material for gloves and mittens. A very satisfactory glove leather is made from horsehides. Various processes are used upon these leathers. An oil tannage makes them very soft and strong, as does also the chrome process. For a very cheap leather the alum tannage is sometimes used. The old calf kid tannage of salt, alum, flour and oil makes splendid glove leather. Heavy calfskins are frequently split, the grain being finished into shoe leather and the flesh into glove leather. Horsehides are tanned to imitate buckskin and the better the imitation the better price it brings. Various shades of color are applied to glove leather. Among the most desired are oxbloods, yellow, olive and brown shades. Many different materials are used to get the shades, but aniline dyes are most commonly used. A tannin mordant is usually required before an aniline is put on, and for this purpose sumac is often used.

Fancy colored skins are best dried out in a darkened room, as a strong light sometimes changes the color. Considerable working is necessary to get the right degree of softness.

The softness of the leather is best produced by the nature of the tannage, and the methods of working of the skins, while the smoothness and strength of the grain are produced by the methods of unhairing and preparing the skins for tanning. Egg yolk and olive oil produce

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good results in nourishing and fatliquoring glove leather. They are applied after the dyeing operation, and after they are well taken up by the leather the skins are pressed or struck out and dried out, then worked and finished.

RECIPE FOR FAT LIQUOR.

An excellent fat liquor for glove leather is made as follows: Ten pounds of Palermo fig soap, 4 gallons of neatsfoot or sod oil and 10 pounds of egg yolk in 50 gallons of water. For calfskins, 6 pounds of degras may be used in place of the egg yolk. The fat liquor should be given to the skins gradually, a gallon or two at a time. Sheepskins may be nicely fatliquored by the use of one pint of egg yolk and one-half pint of olive oil for each dozen skins.

When the coloring is done in drums, the fat liquor should not be applied until after the leather is colored.

FAT LIQUOR FOR GLOVE SHEEP.

For a fat liquor for glove sheep use a mixture of 40 pounds English sod oil and 20 pounds alkali soft soap in 50 gallons of water, using about 1 pailful for each dozen skins.

Another very good fat liquor is made as follows: Ten pounds of soap, 4 gallons of oil and 6 pounds of degras in 50 gallons of water. An emulsion is produced by boiling the soap until dissolved, then the oil is added, next the degras and finally the barrel is filled with water. It is good practice to drum the leather in the warm drum for a few minutes, so as to warm it up before the fat liquor is added. Two gallons of this fat liquor is the maximum quantity required for one dozen medium-sized skins. Before the final oiling off is done, the surplus water should be all struck out of the leather and the grain laid down flat and all wrinkles removed. The oil should be heated to a temperature of 120 degrees and applied evenly over the skin. It will then penetrate into the body of the leather and add strength to the fibers.

GLOVE, LINING AND BINDING LEATHER.

The following process produces very soft, tough leather especially adapted for button fly linings and similar purposes. The resulting leather resembles Napa leather very closely. The skins are treated in the beamhouse in the usual way. Very little or no lime at all is required, the skins being merely depilated either by the use of sulphide of sodium or by a mixture of sulphide of sodium and lime.

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For ten dozen sheepskins of average size, prepared for tanning, a solution is prepared composed of two pounds of caustic soda and one pound of borax in sufficient water to enable the skins to process nicely. This solution and the skins are placed in the drum and milled for thirty minutes, after which the skins are removed from the liquor, hung up and dried out. They are next immersed in a solution composed of five pounds of hard soap, one gallon of straits or neatsfoot oil, one-half pound caustic soda and seventy-five pounds of water. In this solution the skins should remain until they have become thoroughly softened through and through, after which they are put into a drum with a part of the second composition and run for about one-half hour, being then removed and dried as before. They are next softened on a part of the second solution and allowed to drain for a short time.

The skins are next placed in the drum with a third solution and run for about thirty minutes, then put back into the second solution and soaked for one hour, then taken out and hung up to dry, after which they are soaked and softened in this manner two or three times in the second solution, until they are properly prepared. Some skins require longer treatment than others. After the skins have been treated in this manner and have become leather, they are put into a very weak solution of soap, oil and caustic soda thoroughly mixed with water, in order to soften them, and in this moist condition they are colored any desired shade, or if white leather they are allowed to dry without further treatment and then worked soft. By this process a very strong and pliable leather is produced, suitable not only for linings, but also for gloves, as it does not crack nor do the stitches pull out after being sewed. The less lime that is used in preparing the skins the better, and as no acid is used in the process the fibers of the skins are left in their natural state and strength.

ANOTHER PROCESS.

Another process of preparing sheepskins for linings, binders and similar purposes is carried out as follows: The pelts are depilated in the usual manner and then limed for a few days in weak clean limes. For tanning six dozen sheepskins the following composition is used:

RECIPE FOR TANNING.

Eighteen pounds of salt, 2 pounds of sulphuric acid, 36 pounds of

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sumac or quercitron bark, 2 ounces hydrochloric acid, 18 pounds dried clover and 125 gallons of water. The strength of the sumac or bark is extracted with water, then enough salt is added to insure a perfect solution, the acids are added and the whole mixture is thoroughly incorporated by stirring.

The skins are treated to this solution in a paddle vat, although a drum may also be used, and after tanning they are hung up and dried out, then moistened back and either blacked or colored or left white and finished by working and ironing.

To produce quickly and cheaply a soft, tough leather from sheepskins suitable for gloves and mittens or any other purpose where a soft, tough and waterproof leather is desired, the following mixture may be used:

RECIPE FOR TANNING GLOVE LEATHER.

Seven pounds of alum or sulphate of alumina, three pounds of Glauber salt, four pounds of rock salt, ten gallons of soft water, five pounds of ground sumac, three pounds of oak bark, one pound of ground nutgalls and four ounces of sulphuric acid.

In preparing the tanning mixture, the alum, Glauber salt and rock salt in about the proportions named are first reduced to a fine powder by pounding, grinding or by any other suitable manner, and then afterwards boiled in the ten gallons more or less of soft water in a brass, copper or other suitable kettle. The sumac, oak bark and nutgalls are then mixed together and boiled briskly for twenty minutes, more or less, then such mixture while hot is strained in any suitable manner over the alum and salt mixed together as has been stated; the four ounces of sulphuric acid are then added and the mixture stirred constantly until all the ingredients are dissolved. The liquor is preferably used warm, at blood heat, and the skin treated therein for a period of twenty-four hours, being stirred for about one hour and then allowed to rest in the liquor with occasional stirring the remainder of the time. The process can also be carried out in drums, and the skins drummed in the liquor for one hour, then allowed to drain for a few hours.

Upon coming from the liquor the skins are given a thorough striking out on both the flesh and the grain sides with a glass slicker. This is followed by a moderately heavy coat of lard or neatsfoot oil applied to both sides. Then the skins are hung in a warm place and allowed to dry, thus completing the process. By the use of the mixture pre-

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pared as described skins can be tanned very quickly and cheaply and the resulting leather can be colored any desired shade.

If the leather is to be dyed black, nothing more is needed beyond the tanning except something suitable for making the color permanent. The leather is to quite a degree impervious to moisture. Before applying the oil, which should be warm, the water should be thoroughly struck out of the skins. The leather should be worked as it dries, the drying and working continued until the skins are thoroughly dry and soft.

PROCESS FOR SHEEPSKIN FLESHERS.

The following process is especially adapted to sheepskin fleshers, to be used in the manufacture of gloves, for binding, etc. The proportions of tanning ingredients mentioned are sufficient for about two dozen fleshers of ordinary size. The fleshers are immersed, stirred about and pounded for about thirty minutes in a fluid prepared as follows:

One pound of alum is dissolved in one and a half gallons of water, which is readily done by boiling. Then in a separate vessel is mixed one-half pound of flour and one-half pound of oatmeal, or one pound of either alone, with one gill of oil and one and a half gallons of water, and this mixture is mixed with the alum solution. The tanning ingredients may be applied to the skins in a drum, and at the end of thirty minutes they are taken out of the drum. They are then immersed for thirty minutes either in a vat, tub or drum in a fluid mixture composed of one gill of ammonia, one-half of a bar of soap, one-half ounce of soda, one-half pound of salt, and about two ounces of whiting or ochra, all boiled in one and a half gallons of water until they are all dissolved. To this solution is now added either one pound of flour or one pound of oatmeal mixed in one and a half gallons of water, and the fleshers drummed in the mixture for thirty minutes, after which they are dried, staked or worked soft and finished upon either side in the usual manner. The skins dressed by this process are made very soft, pliable and strong of fiber without becoming rough.

After the skins have been treated to the first part of the process they may be dried, staked and finished on either or both sides without being subjected to the second part of the process, and when this is done they are better in quality and are susceptible of taking a better finish than skins dressed in the ordinary manner. Yet it is pre-

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ferable to use the entire process in dressing the skins, as they are thus given a superior quality and a capacity for a better finish than when the first part of the process only is used, and when finished they bear a close resemblance to castor or mocha glove leather.

In order to get the skins soft and elastic and at the same time tough and strong, it is necessary that they be handled in such a way in the early processes of the beamhouse as to prevent any loss of substance or strength. The use of sulphide of sodium in removing the wool shortens the time consumed in the preparation of the skins and at the same time produces tough and well filled leather. A liming of from six to eight days is generally sufficient for sheepskins and after the liming is completed the drenching should be carefully done. The bran drench produces a very soft skin, as does also lactic acid; the latter article being very simple and safe to use. The drenching may be done in a drum, about three quarts of lactic acid being used in 100 gallons of warm water and the skins drummed or milled for not longer than thirty minutes.

Sheepskin fleshers may also be tanned by any of the chrome processes, and well fatliquored. A good practice is to add a solution of flour and water to the fat liquor. This increases the fullness of the leather as well as increases its strength and softness. Very good leather can also be made from the fleshers by tanning them in a mixture of alum, salt, oil and flour, then drying them out and working them soft by staking and tacking. The softness of the alum tanned skins is produced by a mixture of egg yolk and olive oil mixed with the alum and salt or applied immediately after the tanning is completed. The longer the tanned skins lie in the dry state before being worked out and finished the softer and firmer will be the texture of the finished stock.

When the fleshers are received by the tanner in pickled condition they require a drenching in sour bran and salt in order to remove from them the acid before they are treated with the alum and salt process.

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Sheepskins.

DEFECTS IN SHEEPSKINS.

Sheepskins have many defects and it is often the case that skins are sometimes damaged before they come into the pullery. Butchers are very careless and score skins long and deep. Heavy, fine wooled skins are sometimes torn in pulling them from the sheep and the grain is often broken along the flanks and neck, but that is not seen until they arrive in the pullery.

Western skins are dried as soon as they are taken from the sheep, oftentimes in the sun, and many are sunburned. In the warehouses they are poisoned by having a solution of arsenic and soap sprinkled over them, and sometimes they are baled without being thoroughly dried.

Packer skins, country skins and western skins are handled nearly the same. At first they are well soaked in clean water until they are soft and the salt is well out of them.

If they are to be sweated they should be worked on the beam and returned into clean water, for it is impossible to have even pulling skins come out of the sweathouse if any salt is in them.

The soaking can be overdone and they will water prick. If skins are brushed the brushes sometimes get out of order or an unskillful workman will cause hundreds to be grain-broken before it is noticed.

When depilatory is used lambs should be painted with about 18 degrees, sheep can stand 22 to 24 degrees, and old bucks or saddle seats can stand from 25 to 28 degrees.

When skins are painted too strong it will show in tender-grained skins. In painting, careless workmen will sometimes leave a small pool of paint on the skin, or leave some undissolved crystals (if crystallized depilatory is used) that will eat through or leave a yellowish green spot, which will always remain hard.

If not painted strong enough, and they must be repainted, the

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appearance of the skin will not be as good as if it had enough the first time.

The pullers sometimes damage the skin by using the stick too strongly on the necks and butts, but that can generally be attributed to careless painting.

In the liming process hot lime is sometimes thrown into the vats while the skins are being handled, and it shows in pinkish spots, allowing the grain to be rubbed away, leaving the flesh firm; being different from hot water or steam, which will soak both flesh and grain.

In hand fleshing not much damage is done, but machine fleshers cut quite a number.

Skins can be heated by leaving them lie too long before they are pulled, and sometimes they are pricked by leaving them in water too long after they are pulled before they go into the limes; but it is in the bate where they generally get overheated and are spoiled. The pickle does not do much damage unless they do not get strong enough pickle and are stored away for a length of time, when they become mouldy and in time rot.

After they are pickled water should not be thrown onto them unless it is salted.

PICKLING SHEEPSKINS.

As soon as the skins are limed they are trimmed and fleshed, either by hand or machine; they are then run in a drum and well washed, using the old bate liquor if possible.

Some picklers let the old bate liquor run away, but I find it just the thing for washing out limed skins. After they are well washed I work them on the beam, and as they are worked they should be thrown into a vat of clean water.

Some picklers work them after the bate, but I prefer to work them first, for I find that even with good workmen the work is slighted whenever there is a chance, and it is impossible to examine all the work.

By first working them it leaves very little lime and dirt in the skin, and it is in good condition for the bate, which will loosen and wash out all the remainder.

My bate is as follows: I first make my sour by having a vat filled with water, and use enough bran or middlings (I prefer the latter) to make it of the consistency of thick soup, heating it well and letting

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BOARDING LEATHER.

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it stand until it ferments; it is then ready for use. As it is used it should be strengthened by adding middlings and water, keeping it up to the same strength.

The bate should be heated to 80 and 90 degrees, depending on the weather, using 100 pounds middlings and about 15 pails of sour to a pack of 800 skins.

We have very hard water and less middlings might be used with good soft water.

Putting in the skins in the evening, I leave them run a half hour or so, and in the morning the skins are well up and ready to come out.

I make my pickle as follows: For a pack of 800 to 1,000 skins use 175 pounds acid and 500 pounds salt and add one-half of these proportions each succeeding day.

The skins are taken out of the bate in the morning and put into the pickle and run at least an hour, when they are ready to come out.

The pickle vats should be cleaned every week and nice, clean, well pickled skins will be the result.

TANNING SHEEPSKINS.

In order to obtain a yellow color for sumac-tanned skins the following recipe is recommended:

Firstly, clean the skins with salsoda in order to remove the grease, then treat them to a solution of vitriol, diluted with water. Having well rinsed and cleansed them of acid, set them out on a table. Then dilute a half bucket of water with 3 ounces of picric acid which has been previously boiled for four minutes. Sponge the color upon the grain and hang the skins up to dry. Next dampen them with a mixture of half a pint of milk in two quarts of water, after which finish in the ordinary way.

BLEACHING WOOL. (SIX SKINS.)

In order to bleach wool on alum-tanned skins the following method should be adopted: Clean the skins in the same manner as when prepared for lemon coloring. Then hang them in a close compartment and set a vessel in there with a 2-pound stick of sulphur. Heat this with a hot iron. On the following day take the skins out, put them on a frame and tan and finish them in the usual manner.

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MAROON ALUM-TANNED SKINS. (SIX SKINS.)

In a vat containing twelve pails of warm water add two or three pails of logwood liquor. This extract should be the product of 6 pounds of logwood which has been boiled for one hour. Immerse the skins in the solution and handle them for ten or twelve minutes; then let them remain in the liquid for an hour. To a vat containing 15 pailfuls of warm water add three ounces of salts of tin, and into this place the skins and work them for ten or fifteen minutes. Then replace them in the first logwood liquor and handle for four or five minutes. After this process wash them in clean water and tan and finish in the same manner as when prepared for lemon coloring.

THE MANUFACTURE OF SHEEPSKINS INTO KID LEATHER.

Sheepskins for kid leather must be very sound skins and well taken off. Fresh skins are not preferable to salted skins.

Take fifty shearing skins and after the wool has been removed by the sweating process place them in a soak of clean cold water and let them remain over night. In the morning handle them from the soak and place them in an old lime. Handle them daily in the lime for three days, when they are placed in a new lime. To make the new lime put three barrels of clean water in a large tub and add to it one peck of newly slacked lime and plunge well, when it is ready for the skins.

Handle the skins from the old lime and place them in the new one. Handle them daily for four days in the lime, then strengthen by adding one peck of newly slacked lime. Handle the skins daily in the lime again for four days, when they are taken out and placed in a soak of clean cold water. They are now fleshed cleanly on the tanner's beam and placed in a tub of lukewarm water, when they are ready for the bating or drenching process.

THE FIRST DRENCH.

To make a drench for the skins put three barrels of water a little more than lukewarm into a large tub and add to it two pailsful of wheat bran; stir well and it is ready for the skins.

Handle the skins from the lukewarm water and put them into the bran bate or drench. Take a stick and stir them well for ten minutes. Removing the stick from the tub, cover the tub closely,

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and let the skins remain over night, when they will be found to have risen to the surface of the liquor. Stir them again with the stick, this time five minutes, then cover the tub and in about four hours the skins will have risen to the surface of the liquor again. They are now given a good working on the grain on the tanner's beam, when they are ready for the second bate or drench.

THE SECOND DRENCH.

To make the second drench put two and a half barrels of lukewarm water into a large pailful of the old bran liquor and one pailful and a half of wheat bran; stir well and the drench is ready for use.

Place the skins in the drench; stir them well and let them remain over night. Next morning they are taken out of the drench and the bran worked from the flesh, when they are ready for the tawing process.

TANNING.

To tan fifty sheepskins put three pailsful of lukewarm soft water into a tub or other suitable wooden vessel. Then add twelve pounds of alum and nine pounds of salt dissolved by boiling three or four minutes in two pailsful of soft water. Take eight pounds of flour and with some of the alum and salt liquor make it into a very thin batter, then pour it slowly into the tub containing the liquor, stirring it briskly during the time the batter is being poured in.

Handle the skins singly through the liquor, giving them half a minute each in the liquor, spreading them out smoothly one upon another on a horse that is placed immediately over the tub. Care should be taken not to let the liquor waste. Having dipped them through the liquor, put them all, one by one, into the liquor and pound or tramp them for ten minutes, then handle them from the liquor, spreading them out smoothly on the horse. Let them remain on the horse twenty minutes, then stir the liquor well and put the skins, one by one, back into the liquor, where they remain over night. Next morning handle them from the liquor and let them drain an hour, then hang them up by the hind shanks on tenter-hooks and dry them very quickly. They should not be stretched taut on the tenter-hooks.

When the skins have dried out completely, remove them from the tenter-hooks and place them one upon another in a pile on the floor and, weighting them down, let them remain for a week or two to season.

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The skins should be placed to season where there is neither extra heat nor dampness.

The skins having seasoned, fill a clean barrel with soft water and dip each skin in and out of the water quickly. When all have been dipped in the water, place them in a box or barrel and tramp or pound them till they are somewhat softened and packed closely together, then cover them to exclude the air and let them remain till next morning.

The skins, after dumping, having remained in a box or barrel over night, are worked on the knee stake lengthwise and crosswise thoroughly. Then take them to the frame and work them with the moon-knife, when they are ready for coloring.

COLORING.

To color the skins black take them to a table for the purpose and in three suitable earthenware or glazed vessels prepare the following liquors: In the first vessel put three quarts of lukewarm, soft water; add to it 2½ ounces of salsoda, commonly known as washing soda, and when dissolved add ¾ of an ounce of bichromate of potash dissolved in half a pint of boiling water. In the second vessel put 3 quarts of strong logwood liquor of the strength of 2 ounces of the extract of logwood to 1 quart of water. In the third vessel put 3 quarts of soft water and add 1½ ounces of copperas dissolved in half a pint of hot water.

Spread a skin out smoothly, grain up on the table, and brush the grain well with the liquor in the first vessel; then take the second vessel and brush the grain well with the liquor, following with the third vessel; brush the grain well with the liquor and it will appear a blue black. Wash the colored side well with pure water to free it of all sediment. Work or slick the water well out of the skin with a brass or a copper slick; then hang it up where it will dry quickly.

TO FINISH BLACK KID.

After the skins are blacked and well dried dip them in and out of cold water quickly; then put them in a box or barrel and tramp or pound them till they are packed closely together; cover and let them remain over night; then work them well lengthwise and crosswise on the knee stake; this done, work them on the frame with the moon-knife; then rub the flesh well with sand paper and hang up to dry quickly.

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When the skins are dry the grain is seasoned with the following mixture: Dissolve half a pound of palm oil soap, commonly known as castile soap, in 3 quarts of soft water; add half a pint of pure neats-foot oil and beat well till the oil and soapy solution are well mixed, or till the oil will not separate, when the seasoning is ready for use.

The seasoning nourishes the grain, giving it a soft, smooth, mellow feel, and it develops the color.

With a fine sponge give the grain a light coat of the seasoning and hang up to dry; then iron with an iron not too warm.

TO PICKLE SHEEPSKINS.

In pickling pelts after the wool is off, the skin is limed in the usual manner, weak lime being used at the start and gradually strengthened. It is very essential that this part of the process be properly done. Before placing in the pickling bath, the lime should be thoroughly worked out of the skins, which should then be put in a pickle of salt and sulphuric acid. Use plenty of salt and enough acid to cause the mixture to slightly bite the tongue. After remaining in this liquor for forty-eight hours, the skins are ready to be taken out.

Another recipe for a pickling liquor recommends for every 100 sheepskins 50 pounds of common salt and 8 pounds of sulphuric acid, with sufficient water to cover, say, forty or fifty.

TO TAN SHEEPSKINS WITH OAK BARK LIQUOR.

In tanning sheepskins or any other skins, the only difference in using bark and bark extract is the difference in strength, which can be found out by using the barkometer. We would say that in tanning in the paddle you can use a stronger liquor, from the fact that every turn the wheel makes is equal to a handle, so you can start on 4-degree liquor and run as high as 10 degrees, as any skin having open pores will tan quickly.

As regards the best manner of stretching, the frames are considered the best, as the skin will retain the stretch better for staking.

ALUM TANNED SKINS.

The following process is recommended by a practical tanner for coloring wool skins lemon or yellow, the materials used being for the treatment of six skins:

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Place two vessels on the right-hand side of a beam. Into one pour 40 gallons of very warm water and add to it from 3 to 4 pounds of salsoda. The other vessel should contain a pailful of soft soap. Having hung the skins on the beam on the top of each other, wool side up, pour some of the soft soap on the wool and rub it into the wool by hand. Then work it out with the dull side of a flesher and pour some water over the wool. When the skins are all cleaned, put them into a vat containing 15 pailfuls of warm water, with which has been mixed 4 ounces of picric acid that has previously been boiled for five minutes in half a pailful of water; then add 1 tumblerful of oil of vitriol. Move the skins backward and forward for ten or twelve minutes and then take them out and wash them in cold water. They will assume a nice yellow hue when drained. Next, stretch them on a frame and give them a good rubbing with alum water on the flesh side. When dry, clean the flesh side with a moon knife and comb and trim the wool.

To obtain a blue color, the same preliminary preparations are made and 1 ounce of blue aniline, which has been previously boiled for five minutes in a gallon of water, is added to the vat, together with a tumblerful of oil of vitriol. Having well stirred the solution, the skins are immersed and worked in it backward and forward for about fifteen minutes, after which they are allowed to soak for one hour. They are then taken out and half an ounce of boiled blue aniline is added to the bath. The skins are then again immersed, worked as before, and left to soak for another hour. After this they are washed and treated as described above.

PREPARING SHEEP'S PELTS FOR WOOL PULLING.

Sulphide of sodium and slacked lime are commonly used for this purpose. Some pullers take a barrel and fill it about one-third full of sulphide of sodium, which they dissolve by steam. To this, four pails of slacked lime are added. The lime may be slacked in a separate barrel. The mixture of sulphide and lime should stand at 18 to 20 degrees. Water may be added to make this strength right. Lambskins do not need over 13 degrees liquid. The better the pelts are drained, the less stuff they require.

The pelts are soaked until free of blood, salt, etc. They should be thrown into clean water after being withdrawn from the first soak, if the salt, etc., is not entirely dissolved out of them, and then well

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drained. The mixture of sulphide and lime should be applied to the flesh side of the skin like whitewash. It is customary in many pulleries to begin painting the pelts at eleven or twelve in the morning and continuing till night. By next morning the pelts first treated can be pulled, and so on.

As each pelt is treated, throw it on the floor; at night put four or five in a pile, flesh sides together. By next morning the wool can be pulled. The operator should be careful to protect his hands, as the sulphide is liable to eat into them. Lambs do not require as strong treatment as sheepskins. After the wool is removed, wash in reel, and then throw it into lime. The lime vats should hold from half to a full barrel of lime, depending on the size of the vat. Leave three days in lime and handle once or twice during this time. Withdraw the skins, flesh them, and put in a bran drench. This is made by putting about one bag, or 25 pounds of bran over night in a wash reel or vat. The drench will be ready for use the following morning. The skins can be put through it and then worked on the grain. From there they go to the pickle. The skins will float on top in the bran vat, so they must be kept poked down.

UNWOOLING AND PICKLING SHEEPSKINS.

Remove the wool by sweating or liming the pelts, after they have been well soaked. It is difficult to name the quantity of lime to be used, as pelts vary in size and quality. It is customary to slack the lime in a wooden tank or half-barrel, and apply as a paste on the flesh side of the pelts, which should be packed—say, 300 in a pile. After twelve hours, turn over this pile, and in twenty-four hours the wool can be removed readily. After rinsing the lime from the skins, in cold water, they may be pickled as follows: For 200 skins, make a new pickle containing 50 pounds salt and 50 pounds alum, which represents about ¼ pound of each material for each skin. The skins should be properly pickled after being twenty-four hours in this bath. For the next lot, strengthen with half of the quantities originally used, and keep adding 25 pounds salt and 25 pounds alum for each batch of 200 that follow.

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Chrome Harness and Belting.

CHROME TANNAGE FOR BELT AND HARNESS LEATHER.

Before going into details I would like to mention the following: Vegetable tanned leather takes up in the tanning process between 30 to 50 per cent. of its own (dry) weight in tanning material, whereas leather tanned by one of the chrome processes rarely is able to take up even 10 per cent. of chrome of its own weight.

That causes a great difference in the thickness of leather, and a manufacturer who uses hides of a certain weight to produce belt or harness stock of a certain thickness in vegetable tannage will find that the same weight of hides tanned by the chrome process yields only three-fourths of the thickness. But although the leather is about 25 per cent. thinner than the other, its strength, when tanned properly, will still be about double, so that in use a thick vegetable belt or harness strap may be replaced by a thin chrome-tanned piece of leather, and still be of better strength.

The manufacture of chrome leather for belting and harness purposes is exactly alike up to the finish, and I shall therefore treat the manufacture so far together.

GOOD HIDES NECESSARY FOR CHROME TANNAGE.

Every tanner who has had experience with the chrome process knows that hides in which the grain is not well preserved and intact, are more or less unsuited for chrome tannage, as even the slightest default on the grain shows much more than on vegetable tanned leather on account of the peculiarity of the chrome tannage. This is especially important, and I am sorry to say detrimental for harness leather, as it is impossible to hide small imperfections on the grain, whereas this is easily accomplished on ordinary tanned harness leather with all the different finishes.

SOAKING.

The soaking is done according to the state of hide, and just the same as for other leather, but in any case as quickly as possible to

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avoid loss of hide substance. Every tanner has to use his own judgment for this process, and no firm rules can be given.

After having been rough fleshed on the fleshing machine or worked out on the beam, they are put back in the soaks for a few hours and brought in the limes, which are sharpened with sulphide of sodium in the usual manner.

LIMING.

The liming is done more thoroughly than for vegetable tanned stock, to open up the fiber as much as possible, which is accomplished by using fresh limes. No lime is allowed to get older than a month, and the liming process should be accomplished in from seven to eight days.

In the special case I am describing, the hides were suspended in the limes and the limes stirred by machinery, which made it possible to shorten the liming period to five or six days and still have the work done effectively.

After being unhaired the bellies and heads are cut off and the butt is split on a bandknife splitting machine.

In Europe, especially in Germany, splitting out of the limes is quite a usual thing, and scarcely one important firm splits the tanned leather, all preferring to tan the split in an inferior, cheaper and in most cases quicker tannage. In this case offal and split are vegetable tanned, the first one being finished to either colored or black strap leather, the last one being sold in the rough.

BATING.

The butts are then bated in a weak and tepid solution of lactic acid to remove the lime. The bate is preferably applied in a paddle wheel, because the revolving drum invariably causes an important loss of hide substances, which at any rate must be avoided for chrome tannage. The bating process was performed in two or three hours, the strength of the lactic acid solution being 2 per cent.

The bated skins are now fine-haired and washed for an hour or so and allowed to drain on a board for the same period.

Then they are pickled in an ordinary pickle, composed of sulphuric acid and salt. The pickle in this case has only the purpose to quicken the tannage and not to make the leather full and soft, as especially the last quality is only desirable in a certain degree for belt and harness leather. Therefore less salt and more sulphuric acid is taken, making

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a solution of about five parts of salt to one part of sulphuric acid. The pickle is applied cold in a paddle and the hides left in it over night.

Before bringing the skins in the pickle they have to be perfectly free of lime, as the combination of lime and sulphuric acid would produce a deposit of gypsum in the grain, thus making it brittle.

Out of pickle the hides are horsed up, drained and then weighed. This weight is the basis on which the tanning material is calculated.

TANNING.

With regard to the tannage especially for belt leather, I could not advise the use of the two-bath process. Every tanner who has used the two-bath process has his own experiences with it and knows that even the reducing of a heavy calfskin or kip causes difficulties, it being almost impossible to make the hypo solution strike through. It is especially so with cowhide, and a good deal more acid has to be used in the hypo bath to make a good reduction possible. This acid is certainly not conducive to the quality of the leather, and after it has been in use for a short time the grain cracks and peels off on account of the great quantity of free sulphur deposited in the grain by using too much acid. I do not say that this difficulty in reducing chrome leather of a greater thickness may not be overcome, but I always had difficulties with it and in the long run the results for these leathers were not as good as when the one-bath process was used. I know that I am not the only one who has experienced these difficulties, and perhaps more than one skin with a hard, brittle grain might be accounted for by tanners making heavy calf or kip.

Furthermore, the leather tanned by the two-bath process is much more liable to stretch, which is one of the greatest drawbacks of chrome belt leather, and at the same time this leather does not take so much grease as that tanned by the one-bath process, the deposit of free sulphur preventing it.

In the manufactory I am speaking about, as well as in some others making this article, the one-bath process is used. In America the one-bath process is still a patent, and very good liquors especially adapted for this purpose are prepared and sold by different firms.

For the tannage of chrome belt and harness leather I would recommend one of these liquors, for the use of which full advice is given by the makers. The best way to tan this heavy stock is in suspenders, the liquor growing in strength just the same as in the handlers of

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vegetable tannage. According to the strength of liquor used, the time necessary for tanning even the heaviest stock is not more than ten to twelve days, and the liquors may be used till thoroughly exhausted.

When the leather is colored green right through it is taken out of the suspenders and washed in clean water. Borax is not always a necessity and should only be used if prescribed by the makers of the one-bath liquor.

FINISHING OF CHROME TANNED BELT LEATHER.

After being tanned the butts are sorted out suitable for belting and harness purposes and the belting leather is finished in the following manner:

The washed butts are put out by a putting out machine with a vertical table, and are now ready for fatliquoring. The fat liquor forms an undetachable part of the chrome tannage, being considered as belonging to the tannage itself. In this particular case the fat liquor has not only the purpose to act as a tannin, but also to make the leather stiffer and at the same time stronger. The ordinary fat liquor, composed mostly of neatsfoot oil and soap, would render the leather too soft and pliable, therefore quite different proceedings are brought in action here.

After being put out thoroughly the butts are shaved and weighed. This weight is the basis for calculating the amount of grease and soap. The first fat liquor, which in fact is only a soap solution, and the task of which is to do that part of fatliquoring which belongs to the tanning itself, is given in a broad pin wheel, so as to prevent the folding up of the butts.

SOAP SOLUTION.

For 100 pounds of shaved tanned stock 2 pounds of chipped soap are dissolved in about 4 or 5 gallons of water and added to the stuffing drum, where the butts are. The temperature of the soap solution ought to be about 120 degrees Fahrenheit, and the time of letting the wheel go is about twenty to twenty-five minutes.

The soap liquored butts are allowed to lie in a heap and drain over night, which has a very beneficial effect upon the leather in uniting the soap firmly with the fiber.

The next morning they are put out on a vertical table putting out machine, the only one which is adapted for butts, so as to be in an equally tanned condition when being stuffed in the drum. One of

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the most important items in the finishing and the only important one in wheel stuffing is to have the leather in the right state of dampness. Every tanner has to use his own judgment in this case, which he will be able to acquire after a short period of experimenting. All kinds of improvements in connection with mill stuffing have been invented, like heating closets, etc., which are more or less useful.

Just before putting the leather in the heated drum the thinner and looser parts, which are liable to become overstuffed, are dampened lightly with a rag wetted in hot water, so as to prevent these parts taking up too much grease.

The weight on which the calculation of the amount of grease is founded is the weight of the shaved sammied stock.

Of this weight, 10 per cent. is given in the following composition of grease in a regular stuffing drum, fitted up with ventilator and hot-air apparatus.

By experimenting it has been found out that the sammied chrome leather contains 30 per cent. more moisture than the air dry one, so that 10 per cent. stuffing grease on sammied leather means 14.5 per cent. on the finished leather.

STUFFING COMPOUND.

The stuffing compound for chrome belts, as well as for harness, is composed of

50 per cent. of German degras.
40 per cent. of paraffine.
10 per cent. of paraffine oil.
All melted and mixed well together.

The leather is put in the heated drum (120 to 130 degrees Fahrenheit) and allowed to run for five minutes without grease, to get warm. This is only done where no heating closets for the leather are in use. After this the melted stuffing, which may be pretty hot, is added through the axle and the drum allowed to go for one hour. By this time all the grease ought to be taken up by the leather, if not, then allow to run for twenty minutes.

The butts are taken out, piled up over night and covered up, so that they should not cool down and the grease get hard on the surface.

The next morning they are set out on the grain by machine, reset by hand from both sides, nailed on sticks and dried slowly. It is not

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necessary to tack them on frames if the drying is done slowly with aid of a ventilator.

After being dry the butts may be whitened on the flesh with a slicker, although I do not consider this operation necessary, as they have been shaved previously; then they are powdered with talcum and glazed on both sides by hand, and finally brushed by machine.

In Europe the stretching is done by the belt and not by the leather manufacturers.

FINISHING OF CHROME HARNESS LEATHER.

The chrome harness leather is soap liquored and stuffed in exactly the same manner and the same amount of grease is taken as for belting leather.

After being set out the sides are blacked in the usual way on inclined tables with a brush; the first coat applied being a soda solution, the second logwood decoction, then iron black, and finally a second coat of logwood is given. They are then struck out with a slicker and oiled off heavily with paraffine oil, which preferably may be mixed with either neatsfoot or sperm oil (half paraffine, half neatsfoot or sperm oil). Then they are dried partly, reset by hand, dried thoroughly, whitened on the flesh by slicker and finished in any desired way.

In case a dry feeling harness leather is wanted, they are seasoned with a solution of blood albumen, isinglass and nigrosine in logwood, dried and oiled off with paraffine oil.

Sometimes a coat of starch decoction is applied to the flesh side.

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Upholstery Leather.

THE MANUFACTURE OF UPHOLSTERY LEATHER.

Upholstery leather is divided into two classes, fancy enameled and embossed. The former is more generally used, although the latter plays by no means an unimportant part in the manufacture of upholstered furniture.

Fancy enameled leather goes through much the same process as the patent leather used for carriage tops. The hides generally used are from large, spready steers, free of brands, grubs and cuts.

After the process of tanning, preparing, splitting, drying and softening, the hides are turned over to the japanners, who tack them on large frames, when the first coat, called the daub or filling-in coat, is put on with "slickers." The daub is drawn over the hide by the slicker, a blade about ten inches long by five inches wide. The hides are allowed to dry, and then a second coat of the same material is applied. After being in the sun or ovens it receives its paint or color coat, which is repeated after drying. The last application is called the finishing coat. This may be dull or bright, just as desired.

After being thoroughly dried the hides are cut from the frames and taken to the graining room, where, by means of rubbing the flesh side with a graining board, the grain is brought out. The hides are now cleaned on the surface, generally with naphtha paper, which prevents sticking, as the paint is yet comparatively fresh. After being measured the leather is ready for shipment.

Consumers are very apt to complain of leather cracking, but in the majority of cases the fault can be traced right to the consumers themselves, who fail to use proper precautions in handling the stock. It must be remembered that this material cannot be handled like hardware, but requires keeping in a medium temperature. Care should be taken to avoid storing where it is cold.

The colors mostly favored by the furniture trade are dark maroon and dark green. Many others are also used, such as red, brown, blue, orange, pea-green and olive.

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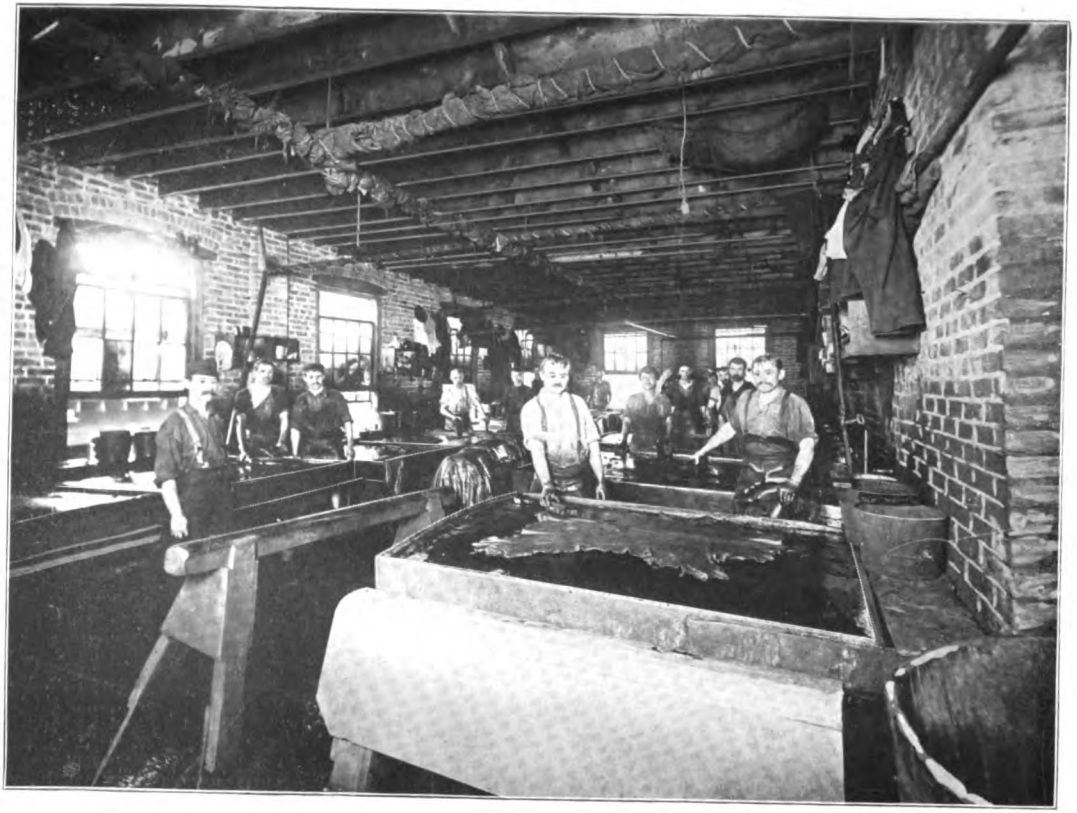

COLORING ROOM.

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Miscellaneous Articles.

TO MAKE LACE LEATHER.

The following instructions may be useful in procuring good lace leather at reasonable cost:

Take cowhides averaging from 25 to 30 pounds each; thirty-five hides will make a convenient soak for a vat containing 1,000 gallons of water; or twenty-five hides to a soak of 700 gallons.

Soak two days or more, as required. Change water every twenty-four hours. Split and flesh; re-soak if necessary. When thoroughly soft, put in limes. Handle and strengthen once a day, for five or six days. Unhair and wash. Bathe in hen manure, 90 degrees in temperature. Work out of drench, wash well, drain four or five hours. Then process, using 45 pounds of vitriol and 600 pounds salt to 700 gallons of water. In renewing process for second or consecutive packs, use 15 pounds vitriol and 200 pounds salt, always keeping stock constantly in motion during time of processing. After processing, drain over night, then put in tan in agitated liquors, keeping the stock in motion during the whole time of tanning.

For tanning, use a gambier liquor of 4 to 6 degrees strong for the first two days. To this liquor add half bag of salt and 15 pounds flour alum, dissolved in boiling water. After forty-eight hours the liquor may be strengthened to 8 degrees and kept there until the fifth day. Then haul up and drain. Press for skiving. In case any of the sides are too heavy, split by machine. Put back in tan three days more, strengthening liquor twice daily to not over 10 per cent., adding another half bag of salt and 15 pounds flour alum.

On the ninth day of tanning strike out on flesh side. Scour on grain and oil on grain with cod oil. Dry out in moderately warm room. Then dampen to stuff. Pack down over night. Use 200 pounds dry leather to each mill in stuffing.

For stuffing use 3 gallons curriers' hard grease; 3 gallons degras; 3 gallons American cod oil.

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Strike out from mill, on flesh. Work out on grain. Dry slowly. Trim and board, length and cross. The stock is then ready to cut.

The time for soaking the hides may be reduced one-half by putting stock into a rapidly revolving reel pit, with a good inflow of water, so that the dirty water washes over and runs off. After ten hours in the soak, put your stock into a drum and keep it tumbling five hours. You gain time and get soft stock at once.

In liming, where the saving of the hair is no object, softer leather is obtainable by using 35 pounds sulphide of sodium with 60 pounds lime. Then when the stock comes from the limes the hair is dissolved and immediately washes off, and saves the labor of unhairing and caring for the hair, which in some cases does not pay.

RECIPE FOR HALF TANNING LEATHER.

In the beamhouse the hides must be high limed and low bated.

To twenty-five sides that would average 40 pounds to the hide in the hair, dissolve in hot water fifteen pounds of Glauber salts, 2 pounds of alum, 2 pounds of borax and 1 pint of sulphuric acid. Dissolve these materials in hot water, which should be added so as to make a four degree liquor. If possible put the hides in a coloring wheel; if not, handle them every half hour for four hours.

These sides should half tan in two weeks. By adding to the strength of the liquor, about the ninth day it should reach 12 degrees, but not stronger. Of course the sides must be handled at least twice each day. The oftener this is done, the greater will be the tanning process.

MISCELLANEOUS RECIPES FOR TANNERS.

FINISH FOR DONGOLA LEATHER OR DULL KANGAROO.

Take 1 pound gum tragacanth, let it lie one week to dissolve. Add to it 4 ounces nigrosine and 1 gill glycerine. The nigrosine must be cooked in 1 gallon of logwood water. This mixture will make from 3 to 4 gallons of finish.

FOR OILING DULL DONGOLA AND KANGAROO.

Heat 4 gallons of neatsfoot oil; keep it hot while oiling leather, and add 4 to 6 ounces of beeswax, according to the mellow feel required on the leather. This should be the finishing touch.

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PASTE FOR SPLITS.

Batter 5 pounds of flour in 2 gallons of water; add 4 pounds tallow, 1 pound beeswax, 8 ounces dry resin, 20 ounces hard soap and 20 ounces gelatine. This make 10 gallons of paste, when cooked. Allow half gallon of water to the paste while cooking.

SCAR PASTE FOR OIL GRAIN OR HARNESS.

Dissolve over night the following: Two pounds brown glue, 4½ gallons water, 1 quart ammonia. Then mix 2 ounces bichromate of potash, 4 ounces of prussiate of potash, 9 ounces XXX extract of logwood. Add these two mixes together and cook ten minutes. If a brighter scar paste is needed add 1 pound of albumen that has been twelve hours in dissolving to the above combination, when cold.

DRESSING FOR HARNESS LEATHER.

A good dressing for harness leather can be prepared as follows: Dissolve by slowly heating

1 lb. Barberry tallow.
1 lb. beeswax.
1 lb. beef tallow (renderings of beef fat).
½ gallon neatsfoot oil.

When the compound is homogeneous, add 1 quart of castor oil, and while the mixture is still hot stir in ½ to 1 ounce of lampblack. Mix all well together, and strain through a cloth strainer and allow the strained portion to cool before putting up in bottles or jars for use.

PASTE FOR FILLING WAXED STOCK.

Take 5 quarts wheat flour; 15 quarts soft water; 14 ounces tallow, and 7 ounces beeswax. Mix the water and flour. Boil until it is a perfect paste. Then add the tallow and beeswax, and stir until the mixture is perfectly effected. If a somewhat stiffer paste is desired, take the same proportions as given before. Let them soak in the water, to which add ¾ of a pound of hard soap and 1½ ounces of white glue. When the glue and soap have been liquefied by the water, add the flour. Boil to a paste and then add the tallow and beeswax.

This paste is a good filler for splits and waxed leather. The man that makes it must exercise some judgment, if the paste is too thick or too thin, otherwise the recipe is very simple.

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WATERPROOFING LEATHER.

The subject of rendering leathers waterproof, or impenetrable to water, has formed the subject of many patents, but with the exception of rendering leather impervious to water by the aid of mineral salts, I have not met with any compound that perfectly waterproofs leather, whether upper or sole, except the following:

As regards mineral process, the formation of sebate of alumina or of iron in the leather, by first steeping the leather in a solution of soap and then in one of either of the above salts, has never yet, in my hands at least, proved its full title to be a perfect waterproofing process; and also the process of rendering gelatine insoluble in the pores of leather by means of an astringent, as alum, does not perfectly fulfill all the conditions necessary for rendering the leather so treated impervious.

As regards stuffing compounds, which depend for their efficiency on filling the pores with some body, such as resin or wax, antagonistic to water, those compounds are far from good, because those of such compounds that cannot be extracted from the leather by heat may be eliminated by means of alkalies, which, by saponification of the resin or wax, render these bodies miscible in water. It was in my experience a short time ago to have submitted to me a waterproofing compound, the solvent for the solid bodies then being benzine. Now, this compound rendered leather impervious to pure water, but it was not waterproof in alkaline waters. As a matter of fact, I completely saponified this so-called waterproofing compound by mixing a little sodic hydrate with it, so much so as to wash my hand with the soap thus formed. In like manner can compounds in which resin is the solid compound for filling up the pores of the leather to make it water-repellant be converted into a miscible compound, while those compounds which depend for these waterproofing qualities on the wax as a compound can be similarly treated by means of borax or borax and ammonia.

One of the most favorite compounds for giving leather the quality of water-resisting is paraffine wax, either driven into the leather by means of heat, or else by means of a solvent, as naphtha, benzine or carbon bisulphide. By this wax can also be extracted again from the leather by either of these means; and if it be upper leather thus waterproofed, the lining of the boot made therefrom will become saturated with the wax if the boot be held in front of a fire; and again, if a spon-

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taneous solution of this or any other wax be used to impregnate sole leather, the wax will be eventually driven out of it by the pressure on the sole when the leather is made up into boots.

After trying some scores of formulæ for producing waterproof leather, I can find nothing better than these two for sole leather. Warm the leather and brush it with a coat of copal or amber varnish; an oil varnish is better than a spirit oil, as the former is more flexible, while for upper leather nothing beats this compound:

1 part by weight of raw gutta percha,
1 part by weight of paraffine wax,
2 to 3 parts by weight of benzine.

The gutta percha should be the raw, brown kind, not the vulcanized or colored kind.

To make this mixture, put the ingredients into a jar or bottle lightly covered with a plate (or plug of wool, if a bottle), and this vessel on the hob of a fire-grate, not too near the fire, or near some source of heat where it will be gradually raised to a warm temperature, but not enough to cause the benzine to vaporize or ignite. After the solids have dissolved, stir the mixture and then, having rendered the leather warm, brush it with this solution, or else steep the leather therein until well impregnated, and then hang up to dry.

The compound, if properly prepared, will set semi-solid, and only requires to be reheated for use as above.

The advantage of this compound is this: Both the wax and gutta percha enter the pores of the leather in a finely divided state and fill them up, while the volatile solvent eventually evaporates out of the leather, leaving the solids therein; now, neither of these bodies, wax or gutta percha, can be completely eliminated from the pores of the leather, because they are so thoroughly combined and in such a fine state that an alkali would fail to saponify the wax, and heat would fail to drive it out, because the gutta percha is worked in by the alkali, and being so intimately impregnated in the pores, it is next to impossible to drive it out by heat; moreover, the gutta percha is a flexible body. And then this compound is an excellent stuffing compound for curriers' use in preparing waterproofed wax calf, satin hide, green hide, pebble grain, etc.

I have tried this waterproofing compound on a score of different kinds of leather, and never found it to fail in rendering them absolutely impervious to water; and, moreover, so water repellant that the leather

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will float in water for hours, sufficient proof then that no water enters the pores again; both these solid bodies are not acted upon by alkalies, and thus I believe I can claim for this compound (one, by the way, which I have formulated after much research)the quality of being a perfect waterproofing compound.

As regards colored leathers—tan, morocco, etc.—I advise one application only applied to the flesh side lightly, not sufficient to stain the leather through; but for upper leathers (kid excepted), the leather may be steeped in the compound, and wiped free of all superfluous drippings.

The following is said to be a very satisfactory process for this purpose: Add to a boiling solution of common yellow soap, in water, a solution of aluminum sulphate, so long as the separation of white aluminum soap takes place; allow the precipitate to subside, wash with hot water, heat moderately for some time to expel water, and dissolve the semi-transparent mass in warm oil of turpentine. Apply to the leather, by means of a brush or by dipping and rolling. Oil and colors may be added to the bath and dried in the air, or more rapidly in a drying room at 90 to 100 degrees Fahrenheit, with care to prevent fire.

Here is another mode of procedure recommended: Take of best white or yellow wax 100 ounces; of burgundy pitch, 6 ounces; ground-nut oil, 8 ounces; iron sulphate, 5 ounces, and essence of thyme, 2 ounces. To prepare this compound the pitch is melted in an iron boiler, and the wax together with the sulphate of iron in another boiler. The melted liquors are then poured together, mixed and kept moderately hot until the compound is liquid and homogeneous. To waterproof leather apply this compound with a brush to the flesh side, with the leather lying upon a hot plate. It may also be used for waterproofing textile fabrics by immersing and then passing through hot rollers.

CHANGES IN LEATHER MAKING.

A great many changes have taken place in the various processes used in making leather during the last twenty-five years. In heavy leather tanning the use of extracts has superseded to a considerable extent the use of barks. Few upper leather tanners at the present time depend entirely upon bark. Some upper sole and belting tanners use the extracts exclusively. The use of extracts was at first looked upon

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with much disfavor until actual experience demonstrated their value, after which their use rapidly increased. When quick results are wanted the use of the extract tannin is of inestimable value to the tanner, as by its use better and quicker results are obtained than when a tanner leaches the bark himself.

USE OF EXTRACT.

Much of the trouble that a tanner meets with at first is caused by his ignorance regarding the best manner of using the extracts. There are many details that must be taken into consideration. Several new tannages have demonstrated their worth during the last few years. Prominent among these is quebracho. This material has steadily gained for itself a place in the tanning world, and its use is constantly increasing. Palmetto extract is another new tan having special and peculiar features. In some respects this tannage resembles gambier, and is, like gambier, especially adapted to the making of light and soft leathers. It is used alone, and also in connection with other tans, such as hemlock and oak extract. It produces good results when used in this way. It produces a leather of a very light color, of considerable strength and good weight. When very tough and firm leather is wanted the extracts obtained from the bark are considered the best; while for sole leather the extract obtained from the wood is by many tanners preferred. A great point is gained when a tanner learns the kind of extract best adapted to his purpose. Many experiments have been tried in the efforts to shorten the time consumed in the making of leather.

QUICK TANNING.

In many tanneries a pack of skins is put into the soak on a Monday morning and within a week or ten days the same skins will be finished and on the counter ready for sale. When it is considered that leather improves by being given plenty of time, it is a question whether the leather that is rushed through the beamhouse and tannery in such a short time possesses the same wearing quality as leather that has been given more time. Yet much of this rapidly tanned leather is strong, durable, of good color and texture, and able to resist long wear; but it is no uncommon thing for such leather, after being finished for a time, to show up undesirable qualities, such as hardness and dryness, thus making it liable to crack. Time is the cheapest thing a tanner can use. Light skins such as sheep and goat are easily

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converted from raw skins into leather inside of two or three hours. Light hides and kips are frequently tanned and finished inside of ten days, where formerly they were given two weeks in the limes alone.

LIGHT LEATHER.

In the making of light leathers, a great many changes have been brought about by the chrome or mineral tannages. These tannages have had a revolutionizing effect in light leather tanning, especially in the making of goat leathers. It was upon goatskins that the chrome tannage was first tried and scored in its first success. Chrome leather is no longer a novelty. Its superior and peculiar qualities are well known, and it will no doubt become a staple product. The chrome process is the direct result of long continued chemical investigation and was brought out by a man outside the tanning world. Many new materials and methods have been adopted since this tannage came into general use.

Years ago the only depilatory in general use upon all classes of hides and skins was lime; but now qualities are called for in leather that lime alone cannot give. These qualities are greater softness, elasticity, and a smoother, clearer and stronger grain. Lime used alone makes the leather too hard. It also roughens the grain, and while it gives considerable spread to the skins, it causes them to be very flat. Where a great deal of elasticity is required in the leather the use of red arsenic used in connection with the lime gives the best results. With most kinds of shoe leathers sulphide of sodium mixed with the lime is proving the material to use. The sulphide of sodium prevents the grain from becoming rough, at the same time it thoroughly removes all the fine hairs and gives a soft skin with a close fine grain. By its use the time consumed in preparing the skins is considerably shortened.

For sheepskins a solution of sulphide of sodium mixed with slack lime is generally used, although the sulphide may be used alone. For goatskins intended for glazed kid, red arsenic and lime is considered the best procedure, also for glove leather, while for other hair skins and for dried hides the sulphide of sodium cannot be beaten. It brings the dried and withered hide or skin back to its natural soft condition in a short time, besides freshening up and toughening the grain. All classes of hides and skins intended for leather in which

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softness and pliability are required need a very thorough soaking and softening and a careful liming and washing before they are tanned.

THE BEAMHOUSE.

While some changes have taken place in the beamhouse treatment, these processes have not undergone a very radical transformation. What changes have taken place have been improvements in the manner of using materials already in use rather than by the introduction of many new materials. The processes are much cleaner and consume less time than formerly. It is generally recognized among tanners that much of the quality and texture of their finished leather is determined by the practices followed in the beamhouse. Damage done to stock during liming or drenching can never be overcome. As a tanner becomes more experienced in his work he learns that to use soaks over and over until they become foul and putrid, and to use limes until they are filled with dirt, are expensive forms of economy. The importance of cleanliness is becoming more clearly recognized, and while even the most up-to-date beamhouse may not be the pleasantest place in the world, it is vastly superior in this respect to the beamhouse of a generation ago.

COLORING.

In coloring and finishing processes many changes have taken place and many new materials been introduced. Wood and extract dyes were formerly used to the exclusion of all other dyes, while today the aniline and sulfamine colors are used in the place of the old materials. Alizaime dyes have not become very popular, owing to the difficulties at first met with in using them on tanned leather. A great deal of heat is required in order to fix alizaime dyes upon leather and for this reason they cannot be safely used on vegetable tanned skins, while on chrome leather when properly used they produce very good results.

The alizaime dyes require a chrome mordant and for this purpose bichromate of potash, when assimilated with lactic acid, produces good results. Sulphuric and muriatic acids, often used in leather coloring, cannot be used in connection with alizaime dyes. Wood dyes are more durable and fast to the light; that is, less liable to fade; but they are also not so brilliant, and are much more expensive. The great point in favor of the aniline dyes is that they are more readily applied to leather; they generally require no mordant, as the tannic acid in the leather is a mordant of itself.

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Success in making colored leather can only be achieved by strict attention to the details. The great difference between good and poor tanning depends upon the little things. The tanner who attempts to imitate his competitor without paying close attention to the smallest detail, will not score a success.

Shoe leathers of the present time have reached a point where in addition to possessing solid worth and durability they must please the fickle popular fancy, which just now runs to light and medium weight leathers finished on the grain, with a bright gloss.

GLAZED FINISH.

The glazed kid finish is nowadays applied to nearly every class of hides and skins where formerly it was used only on the finest kid. The term waterproof is sometimes applied to such a finish, but the term is somewhat misleading. Glazed leather is seldom waterproof except in a small degree. Repellant is a better word. The liquors that are used in getting the glazed finish are solutions of albumen size, blood and black dye. In order to get a high finish the leather is given two or three coats of the seasoning liquid. These are well rubbed in and thoroughly dried. Then the leather is glazed under good pressure.

The glazed finish is best applied to chrome tanned leathers, owing to the dry nature of this tannage and the small quantity of grease used upon it. The smaller the quantity of seasoning put on to bring good results, the better it is, as the leather will stand handling better.

SCUM ON HARNESS LEATHER.

First, if the liquor in the vats gets too old and too much gallic acid is formed such leather will scum.

Second, if leather is blackened before it is dry it will scum.

Third, if the black setters set their leather with too dull slickers they do not get the grease out of the pores, especially where old grease is used.

Some currying shops are built over the yard or beamhouse and the floors are not very tight, the moisture from below will cause the leather on the nails to draw on.

If sufficient steam is turned on, have steam in daytime and at night let steam go down. What it dries out in daytime will draw on at night. This will cause the leather to scum.

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FAT LIQUOR FOR DRAB GLOVE LEATHER.

Cook 14 pounds of olive chip soap in 25 gallons of water. Add 4 pounds powdered borax. Cook together until dissolved, then add 3 gallons moellon degras and 3 gallons light-colored sod oil.

Cook a few minutes, then add enough cold water to make a barrel holding 50 gallons all together, which will be sufficient to fatliquor seventy sides of horsehides. Mill steam for ten minutes, keeping temperature at 145 degrees. Then put leather in and run mill one hour; take out and hang up to dry.

GOOD BATE FOR KANGAROO AND GOAT SKINS.

Take a half barrel of bran, add enough water to make it mushy, then cover up and let it stand for some forty-eight hours, to sour. Now tip this into a vat, say four feet wide by five feet deep and eight feet long, half filled with water. Add about 1½ quarts of vitriol and 3 pecks of common table salt, mix together and heat to 90 degrees.

In regard to the vat, just enough water is required to lift the skins so that they will touch the paddle wheel. Throw a pack, say 400 to 450 genuine kangaroo or goat skins, into the vat, and keep the paddle turning for four or five hours, certainly not longer than five hours; this is where discretion comes in. Heavy skins should be treated longer than light skins.

After the paddling, the skins will be found to be free from dirt and undesirable matter, and will be so clean as not to need working on the beam, except if intended for coloring, when the grain has to be particularly clear. For black leather, the bating alone will suffice.

After being taken from the bate, the skins should be washed in warm water, whether they are intended to be worked over or not, and they will then be in splendid condition.

A SCAR PASTE.

4 ounces extract of logwood.
½ ounce of bichromate of potash.
¼ ounce carbonate of potash.
⅛ ounce of copperas sulphate.
1 pound of frozen glue.
1½ gallons of water.

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Dissolve the logwood and bichromate of potash in one dish.

Dissolve the carbonate of potash and copperas sulphate together.

Dissolve the frozen glue in a little water. When all are dissolved mix well and cool. This is used to cover up scars and scratches, and is put on and dried. Then use your finish.

A BLOOD FINISH FOR GLAZING.

½ ounce of bi chromate of potash.
1 ounce of prussic of potash.
4 ounces of extract of logwood.
Dissolve in two gallons of water and let cool.

Use for this receipt two gallons of blood and two gallons of logwood liquor. Mix well and box back and forth.

TO KEEP BLOOD.

Dissolve 1 pound of carbolic acid crystals in four quarts of water. Put this in one barrel of fresh blood and it will keep for years.

KANGAROO GLAZE FINISH.

For 9 gallons of finished black take the following:

Use 15 pints of ox blood for kangaroo, and for goat skins about 12 to 14 pints. One pint of water and 1 pint of milk. Two tablespoons of glycerine. One-half pint of orchill (Klipstein's). One and one-half pints of nigrosene water (½ pound per gallon). One pint of ammonia (3F). Then fill up with strong logwood liquor. This makes 9 gallons of finish.

CHROME GLAZED KID FINISH.

3 quarts logwood liquor.
1 quart blood.
¼ pint of orchill.
1 pint of water.
¼ pint of ammonia.
A little milk, say about ½ glass.

GRAIN BLACKING.

This can be used on all kinds of grain leather.
As a mordant take, say, 50 gallons.
1 pound caustic soda.

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1 pound carbonate of potash.
Stain, say, 50 gallons.
3½ to 5 pounds of carvoline in crystals (Pickhardt & Kutruff's).
¾ pound of carbonate of potash.
1½ pounds of fustic.

STRIKER OR SET.

5 pounds of copperas.
2½ pounds of blue stone.
50 gallons of water.

HOW TO MAKE TINCTURE OF IRON LIQUOR.

4 quarts of nitric acid.
2 quarts of boiling water.

Put in a crock and use new hoop iron. Give it all the iron it will cut, and feed slow, so as not to burn.

When all through cutting, let it stand and cool and settle, and then draw off.

OAK STAIN FOR HEMLOCK LEATHER.

13 pounds of extract of quercitron bark.
10 pounds of alum.
12 pounds of sumac.

Boil in ½ barrel of water until all is dissolved, and then fill up the barrel with water, and stir well before using. Use warm, say about 100 to 105 degrees, with a brush, after scouring.

In using the sumac it would be better to have it in a bag. It will take a little longer to get the strength out, but it will not cause so much trouble in straining afterwards.

OIL BLACK.

20 pounds lamp black.
2½ pounds logwood extract.
70 pounds of tallow.
12 gallons good bark liquor.

After mixing boil for twelve hours, and when cool stir well, to keep from separating. The above black is changed more or less to suit different stock, the same as finishes are changed, as no one finish will work the same on all kinds of stock, and should be manipulated to get the best results.

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TANNERY MACHINERY.

One of the greatest mistakes made in setting up tannery machinery is the lack of a good foundation.

Take the fleshing machine and unhairing machines in beamhouse work which are run at a high rate of speed, and with a poor foundation the machines will wear and shake, and the cost for repairs is very heavy. All such machines should be placed on a stone foundation, and bolted down with anchor bolts. The average tanner may think this very expensive, but in after years he will more than pay for it in the saving of repairs on his machinery.

The fleshing machine cylinder corners of the knives should be ground off at least once a week, and when the knives are being sharpened. In order to do this a man should use a clipping machine with an emery wheel.

By keeping the corners well rounded you will never have any trouble with cutting stock on the flanks.

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Tannery Labor.

WAX CALF AND KIP WAGES.

The following is the scale of wages and list of prices for piece work now being paid in a representative tannery of Chicago:

SKIVERS AND SHAVERS BY HAND.

Bellies:	
Hemlock Side-Leather	$1.80
" Hy, M, L, Kips	3.15
" Hy, M, L, Calf	3.15
Flatted all over:	
Gambier Side-Leather	$2.70
" Hy Kips	3.60
" M, L, Kips	3.15
" Hy, M. L, Calf	2.25
Shaved all over:	
Hemlock Sides	$4.50
" Hy Kips, M, L	5.40
" Hy Calf, M. L.	3.60
Gambier Hy Calf	4.50
" M, L, Calf	3.60
Flesh and Grain Splits	1.50
Time work, per hour	.30

UNION SPLITTING MACHINE.

Hemlock Side-Leather, L. M. & H.	$2.25
" Hy Kips	1.80
" M, L, Kips	1.57½
" Hy Calf, M. L.	1.35
Gambier Side-Leather (Russia, etc.)	3.15
" Hy Kips	3.60
" M, L, Kips	3.15
" Hy Calf	2.25
" M, L, Calf	1.67
Calf Heads (all kinds)	.31
Re-Splitting Sides	1.80
Re-Splitting Kips	1.57
Flesh Splits	.75

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WHITENING.

Large upper	per dozen,	$	.78
Med.	" "		.65
Small	" "		.54
Large kips	" "		1.00
Heavy	" "		.86
Med.	" "		.76
Small	" "		.65
Heavy Calf	" "		.59
Med. and Light Calf	" "		.48
Deacons	" "		.48
Flesh Splits	" "		.49

The wages paid are as follows: Beamsters, $9.90; tan yard handlers, $9; scouring machine operators (Vaughn machine), boys, $7 to $8; setters and hand scourers, $9.90; printing and pebbling machine operators, men, $9.90; glazing machine operators, men, $9.90; staking machine operators, boys, $7.50; men, $9.90; boarders, hemlock and gambier, $9.90; wax calf and kip finishers, $10.80; finishers in Gambier tanned leather, men, $9.90 to $10.80.

WAGES FOR CALF, KIP AND SIDE LEATHERS.

The following is the scale of wages paid in a representative Milwaukee tannery:

SKIVERS AND SHAVERS BY HAND.

Bellies:		
Hemlock Side-Leather, Hy Kips		$2.75
" " " M. Kips		2.33
" " " L. "		1.90
" " " Hy and M Calf		1.50
" " " L and M Calf		1.28
Flatted All Over:		
Gambier Leather; Hy Kips		$2.75
" " M		2.33
" " L		1.90
" " Hy Calf, M		1.50
" " L		1.28
Shaved all over:		
Hemlock; Hy Kips		$5.52
" M "		4.67
" L "		3.83
" Hy and M Calf		2.97½
" L Calf		2.55

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Gambier; Hy Kips 5.52
" M " 4.67

Shaved all Over:
Gambier, L Kips $3.83
" Hy and M Calf 2.97½
" L Calf 2.55

UNION SPLITTING MACHINES.

Hemlock Side Leather:
Whole hides, weight 25 to 60 lbs.
Large sides $1.91
Small " 1.70
Light " 2.55
Extra Light Sides 2.97
Hemlock; Hy and Med. Kips 1.70
" L Kips 1.28
" Hy, Med. and L Calf 1.28

Gambier Side-Leather:
Whole hides weighing 25 to 60 lbs.
Large sides $1.91
Small " 1.70
Light " 2.55
Extra Light Sides 2.97
Gambier; Hy and Med. Kips 2.98
" L 1.36
" Hy, Med. and L. Calf 1.36
Flesh Splits ..... .51

WHITENING.

Heavy Kips	per dozen	$ .63	3-4
Med. "	per dozen	.47	2-3
Small "	per dozen	.43	4-10
Hvy, Med. and Light Calf	per dozen	.38	4-10
Deacons	per dozen	.30	6-10
Flesh Splits	per dozen	.20	4-10

Ten hours constitute a day's work. The wages paid are as follows: Tan yard handlers, per week, $8; shaving machine operators, according to efficiency, per week, $10; scouring machine setters, $10.50; printing, pebbling and glazing machine operators, men, $7.50 to $9; staking machine operators, boys, $5 to $6. Boarders, hemlock and Gambier, $9; wax, calf and kip finishers, piece work.

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CHICAGO CALFSKIN TANNERY WAGES.

Week work—Beamsters, $10 to $11 per week; floor hands or chores men, $9 to $10; yard hands, $8 to $10; fleshing machine operators, $11; shaving machine operators, $8 to $12; printing, pebbling and glazing, $7 to $9; staking machine operating, boys, $5 to $6; boarders, hemlock and Gambier, $9.

WAGES IN A NEW YORK STATE TANNERY.

Wages per week—Beamsters and fleshing machine operators, $9; yard handlers, $7.75; hand shavers, $14; scouring machine operators (Vaughn), $9; (Fitzhenry), $10.50; setters, $9; operators on printing, pebbling, glazing and staking machines, $10; whiteners, $14; boarders, $8; blacking machine operators (wax calf), $9; hand glassers and pasters, $10. Working week contains 59 hours.

COST OF LABOR AND MATERIALS.

The following has been found in practical experience to be the cost of labor and materials in the tanning and currying of collar, strap, skirting, bridle, seating, line and all fair leathers:

Beamhouse labor	6c	per side
Yard labor	3c	per side
Pressing and milling labor	½c	per side
Skiving labor	1¾c	per side
Splitting labor	1 2-3c	per side
Shaving labor	¾c	per side
Milling labor	¼c	per side
Pressing labor	¼c	per side
Currying labor	½c	per side
Milling labor	1 1-3c	per side
Setting out labor	4c	per side
General labor, engineers, foremen, clerks, watchmen, etc	16c	per side
Total labor cost	36c	per side

The cost of the materials used exclusive of hides is as follows:

Lime	1c	per side
Bark	13c	per side
Grease	11c	per side
Total	25c	per side

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It will thus be seen that the total cost of labor and materials is 61 cents per side of 24 feet.

CALFSKIN TANNERY LABOR.

In calfskin tanneries a careful system of computing the cost of labor is necessary. The profits are small and the tanner finds that he must know exactly what his leather is costing. In many departments, where the piece-work system is not used, a careful list is made out showing what constitutes a day's work for each operation through which the skins are put. In the beamhouse the following is a fair estimate of a day's work at unhairing:

Medium kip	150 skins per day
Heavy calf	175 skins per day
Medium calf	200 skins per day
Light calf	250 skins per day
Deacons	275 skins per day

On the fleshing machines three men will flesh out of the soaks a pack of 1,200 skins, and the same men will flesh from the bates 1,200 skins, and clean up the machinery and take up all fleshings.

In finishing wax calfskins the following card is used, showing what constitutes a normal day's work for a tannery employe:

	Light calf.	*Med. calf.*	*Hvy. calf.*	*Med. kip.*
Shaving by hand	90	84	76	80
Scouring on grain	500	450	400	350
Setting out on machine	300	260	250	210
Setting out from machine	100	88	80	...
Setting by hand	80	70	65	60
Whitening	66	60	54	48
Priming by boy	350	325	275	250
Boarding	125	115	100	95
Glassing from machine	190	180	170	160
Man to paste and boy to hang up, per hour	75	70	60	55
Glass out paste, per hour	75	70	60	55
Man to gum and boy to hang up, per hour	100	90	30	20

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The Schultz Chrome Tannage Patent.

Chrome has so largely superseded the vegetable tanning agents in the production of kid, calf and side upper leathers that a good deal of interest attaches to the original Schultz patent under which a royalty was paid upon every skin tanned during the life of the patent. It has therefore been deemed advisable to reproduce here the formal specifications of the letters patent granted to Augustus Schultz as follows:

TAWING HIDES AND SKINS.

(Specification Forming Part of Letters Patent No. 291,784, Dated Jan. 8, 1884. Application Filed May 31, 1883. No Specimens.)

To All Whom It May Concern:

Be it known that I, Augustu.. Schultz, a citizen of the United States, residing at New York, in the county and state of New York, have invented a new improved Process of Tawing Hides and Skins, of which the following is a specification:

This invention relates to a new process for tawing hides or skins, said process consisting in subjecting said hides or skins to the action of compounds of metallic salts—such as bichromate of potash—and then treating the same with hyposulphite of soda, by which term is understood that salt which is more recently sometimes called "thiosulphate of soda." ($Na_2S_2O_3$.)

In carrying out my process I unhair the raw hides and prepare them in the same manner in which they are made "ready" for tanning. If the hides have not been pickled I subject them to the action of a solution of bichromate of potash in the presence of an acid—such as hydrochloric acid—or, if the hides have been pickled, they may be treated in a solution of bichromate of potash in water without the addition of an acid.

In this solution the hides are left for a shorter or longer time, according to their thickness and to the strength of the solution employed. A skiver or the face of a sheepskin can be done in a strong solution, as above described, in about fifteen minutes, while a full skin "roan" would require in the same solution about one hour. I call the solution "weak" if it contains 5 per cent or less of the weight of skins of bichromate of potash, and I call the solution "strong" if it contains more than 5 per cent of bichromate of potash. It is not material, however, how strong the solution is.

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The skins are completed if small pieces cut from the thickest parts of said skin show that the solution has entirely penetrated. The skins are then ready to be taken out, and after the adhering liquor has run off the skins are introduced into the second solution, which consists of hyposulphite of soda dissolved in water, and adding an acid, such as hydrochloric acid. The solution may be strong or weak of hyposulphite, and the quantity of acid used at first may be less than requisite to split up the entire quantity of hyposulphite, and more acid may be added if the skins show that more is required, which is indicated by the color of the skins. When they are done they show a whitish, bluish or greenish color, according to the time they are kept in the hyposulphite solution.

A skiver which first has been exposed to the action of the bichromate for fifteen minutes will be ready by remaining in the hyposulphite solution about twenty minutes. For thicker skins a proportionately longer time is required. For some skins—such as calf or steers' skins—it is desirable that the same, after having been withdrawn from the second or hyposulphite solution, shall be returned to the bichromate solution, which imparts to them a brownish color and leaves them in a favorable condition to be colored black. The coloring can be done after the skins leave the hyposulphite solution, and after they have been exposed for the second time to the bichromate solution. The leather coming from the hyposulphite solution is especially adapted for light or dark colors, and by proper dyeing methods better and brighter colors can be produced than on leather done by tannin. After the leather is treated in the manner above indicated, it may be colored, soaped and greased in the usual way.

Leather can also be made by reversing the operation and first soaking the hides in a solution of hyposulphite of soda and then exposing them to the action of the bichromate solution. By using the solutions indicated at a heat of about 80 degrees Fahrenheit the process will be done in a shorter time than if the solutions are used cold.

By my process the gelatine contained in the hides is rendered insoluble by means not injurious to the leather. If leather made by tannin is put in a strong soda solution the tannin is extracted and a dark brown liquor is formed. If leather made by my process is put in a strong soda solution the liquor obtained shows only a little milky color.

Leather made by my process is very strong, soft, elastic, and my process is applicable to hides or skins of every description.

What I claim as new and desire to secure by Letters Patent is—

The within-described process for tawing hides and skins, said process consisting in subjecting the hides or skins to the action of compounds of metallic salts—such as a solution of bichromate of potash—and then treating the same with a compound containing hyposulphurous acid (or as it is otherwise called, "thiosulphuric" acid), such as a solution of hyposulphite of soda or potash in the presence of hydrochloric acid.

In testimony whereof I have hereunto set my hand and seal in the presence of two subscribing witnesses.

AUGUSTUS SCHULTZ (L. S.).

Witnesses: W. Hauff, William Miller.

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(SPECIFICATIONS FORMING PART OF LETTERS PATENT No. 291,785, DATED JAN. 8, 1884. APPLICATION FILED JULY 18, 1883. NO SPECIMENS.)

To All Whom It May Concern:

Be it known that I, Augustus Schultz, a citizen of the United States, residing at New York, in the county and state of New York, have invented new and useful improvements in Tawing Hides and Skins, of which the following is a specification:

This invention relates to a new process for treating hides or skins, said process consisting in subjecting said hides or skins to the action of a bath prepared from a metallic salt—such as bichromate of potash—and of then treating the same with a bath containing sulphurous acid.

In carrying out my process I unhair the raw hides and prepare them in the same manner in which they are made ready for tanning. If the hides have not been pickled I subject them to the action of a bath of bichromate of potash in an acid, such as hydrochloric acid; or, if the hides have been pickled, they may be treated in a solution of bichromate of potash in water without the addition of an acid.

In this solution the hides are left for a longer or shorter time, according to their thickness and to the strength of the solution employed. A skiver or the face of a sheepskin can be done in a strong solution, as above described, in about fifteen minutes, while a full skin "roan" would require in the same solution about one hour. I call the solution weak if it contains 5 per cent or less of the weight of the skins of bichromate of potash, and I call the solution strong if it contains more than 5 per cent of bichromate of potash.

The skins are done if small pieces cut from the thickest part thereof show that the solutions have entirely penetrated. The skins are then ready to be taken out of the solution, and, after the adhering liquor has run off, the skins are introduced into the second bath, which consists, by preference, of sulphite of soda dissolved in water, to which an acid—such as hydrochloric acid—should be added, in order to set free the sulphurous acid.

The hydrochloric acid or its substitute may be added to the bath in a free state or through the medium of skins previously pickled, such skins being impregnated with the proper acid. The solution may be strong or weak of sulphite, and the quantity of acid used at first may be less than requisite to exhaust the bath of the sulphite, and more acid may be added if the skins show that more is required, which is indicated by the color of the skins. When the skins are done they show a whitish, bluish or greenish color, according to the time they are kept in the sulphite bath. A skiver which first has been exposed to the action of the bichromate bath for fifteen minutes will be ready by remaining in the sulphite bath about twenty minutes. For thicker skins a proportionately longer time is required.

For some skins—such as calf or steer skins—it is desirable that the same, after having been withdrawn from the second or sulphite bath, shall be returned to the bichromate bath, which imparts to them a brownish color and leaves them in a favorable condition to be colored black. The leather coming from the

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sulphite bath is especially adapted for light and also for dark colors, and by proper dyeing methods better and brighter colors can be produced than on leather done by tannin. After the leather is done in the manner above described it may be colored, soaped and greased in the usual way.

Leather can also be made by reversing the operation and first soaking the hides in a sulphite bath, and then exposing them to the action of the bichromate bath. By using the baths described at a heat of about 80 Fahrenheit the process will be done in a shorter time than if the baths are used cold. Tawed leather made by my process is very strong, soft and elastic, and my process is applicable to hides or skins of every description.

Instead of using sulphite of soda I can use other sulphites or bisulphites in presence of an acid or an aqueous solution of sulphurous acid.

What I claim as new and desire to secure by Letters Patent is—

The within-described process for tawing hides and skins, the said process consisting in subjecting the hides or skins to the action of a bath prepared from a metallic salt—such as bichromate of potash—and then to the action of a bath capable of evolving sulphurous acid—such as a solution of sulphite of soda—in presence of another acid—such as hydrochloric acid—substantially as described.

In testimony whereof I have hereunto set my hand and seal in the presence of two subscribing witnesses.

AUGUSTUS SCHULTZ (L. S.).

Witnesses: W. Hauff, E. F. Kastenhuber.

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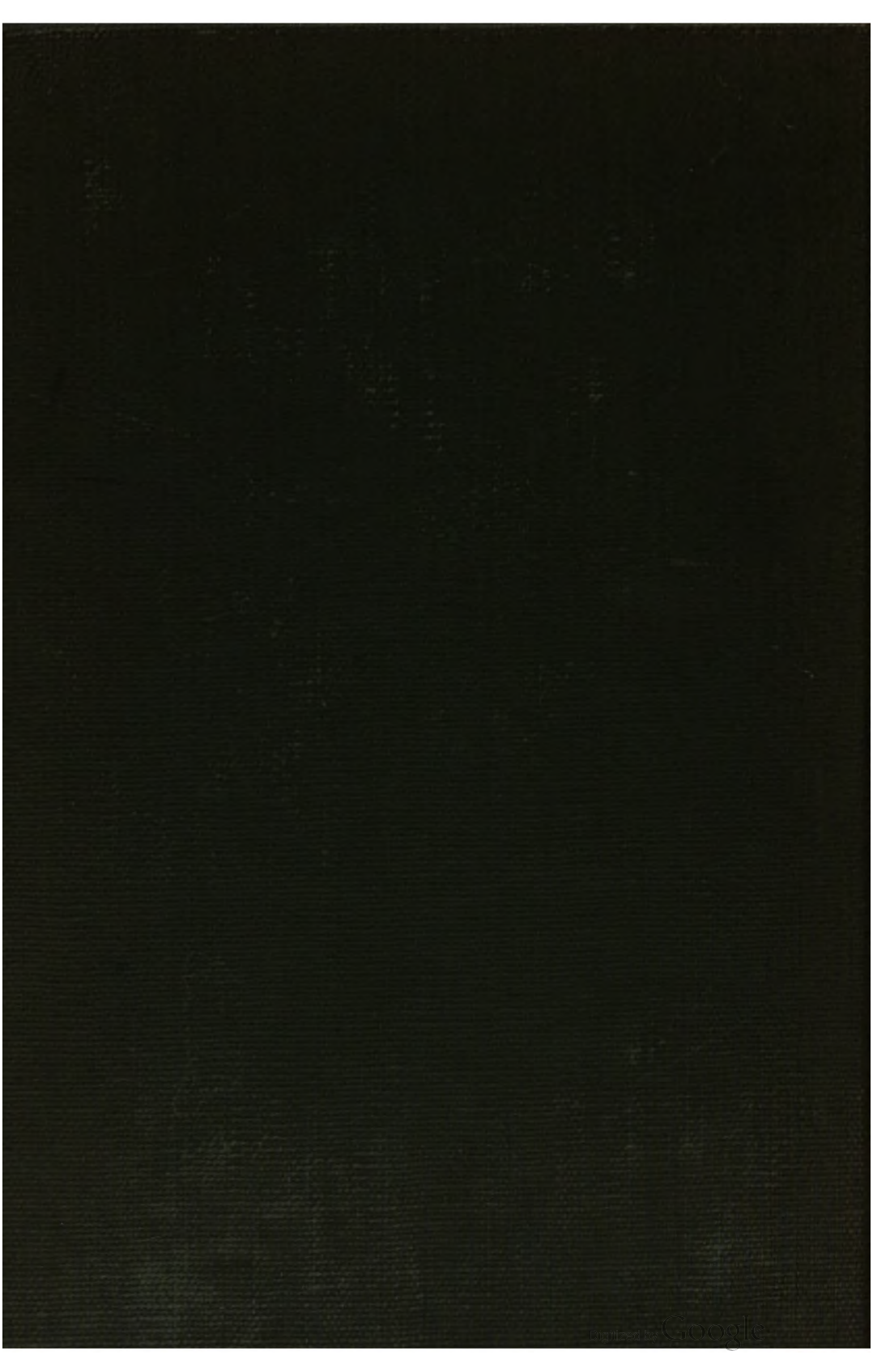

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